



Premier Farnell



EU Directive 94/9/EC - Equipment and Protective Systems intended for use in potentially explosive atmospheres (ATEX)

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1 Introduction

European Union (EU) Directive ATEX95 94/9/EC commonly called "ATEX" covers electrical and non-electrical equipment that is used in potentially explosive atmospheres. Explosive atmospheres may be present where flammable solvents or combustible dusts such as flour are used. Flammable solvents may be used for cleaning or as an additive to a process. Equipment that is used in these environments must be designed to avoid causing an explosion or fire, i.e. avoid sparks and other ignition sources and they cannot be put onto the EU market until approved by a Notified Body who will issue a Certificate of Conformity.

There is another related directive called the ATEX 137 Workplace Directive 99/92/EC (DSEAR - Dangerous Substances & Explosive Atmospheres Regulations - in UK). This is concerned with the safety of the workplace and requires the user to carry out a risk assessment and mark hazardous areas according to risk. "Zones" are defined which are based on the risk levels and these relate to the Categories defined by the ATEX equipment directive. Both of these ATEX directives are currently in force in the EU.

ATEX is an EU Directive and equipment sold in other parts of the world may need to meet different local legislative requirements. In North America, documentation is submitted to an appropriate approvals body and testing is also carried out. In the rest of the world, most countries use IEC Standards as national standards.

2 Scope

Any equipment that is used where there is a risk that the atmosphere will contain flammable or explosive mixtures of air and gases, mists, dusts, vapours, etc., even if this is unlikely to occur. New and used equipment and some types of components, such as relays, that are placed on the EU market and put into service has to comply. This includes equipment made for own use.

- ATEX 95: Manufacturer
- ATEX 137: User

2.1 Exclusions

ATEX specifically excludes certain categories of equipment which are:

Medical devices used in medical environments (these would be covered by the Medical Device Directives).

Domestic and non-commercial equipment where potentially explosive atmospheres are rare

Personal protective equipment, Marine shipping and offshore equipment, transport such as cars and trains (but not if these are used in explosive atmospheres) and equipment designed solely for military purposes. Equipment used where the risk is due only to the presence of explosive or chemically unstable substances is also excluded. Simple mechanical products such as clockwork timepieces and self-closing doors are also excluded but forks for fork-lift trucks would be included.

2.2 Equipment categories

Equipment within the scope of ATEX is divided into two groups. Group I is for equipment used in underground mines and surface installations. Group II covers other equipment and this is divided into three categories.

Category 1. Equipment that requires the highest level of protection as it will be used for long periods in potentially explosive atmospheres, and must be able to provide protection even if one means of protection fails or if two faults occur. or if two faults occur.

Category 2. Equipment needs a high level of protection for use where potentially explosive atmospheres are likely to occur.



Category 3. Equipment in this category will have a normal level of protection and is intended for use where potentially explosive atmospheres are infrequent or exist for short periods only.

The frequency that potentially explosive atmospheres may be encountered is the basis of the zones defined by the ATEX 137 Workplace Directive. There are six zone classifications, three where the risk is from gases and three where the risk is from dusts. Zone 0 (gases) is the highest level of risk and so only Category 1 equipment is likely to be acceptable. Zone 1 is where potentially explosive atmospheres (due to gases) are likely and Zone 2 is where they are unlikely or may be present for a short time and so Category 3 equipment could be used. Zones 20, 21 and 22 are the equivalent dust risk zones

3 Requirements

Equipment that needs to comply with ATEX must be designed in such a way as to meet the general requirements of the directive. The main principles are to prevent explosions, avoid all sources of ignition and if an explosion were to occur, to halt it as soon as possible.

There are many design requirements and a few are summarised here:

- Designs must be analysed to determine where possible faults may occur that cause ignition
- Equipment must withstand conditions within the environment in which it will be used.
- All equipment must include instructions and the directive specifies what these must include.
- Materials must be selected to avoid triggering an explosion. For example, plastics should not be used if these are likely to fracture as a result of contact with solvents.
- The design and construction should avoid triggering explosions with attention, for example, to enclosures to prevent leaks (keep explosive mixtures out or to contain explosive mixtures) and to avoid dust build up.
- Avoid potential ignition sources such as static discharge, stray leakage currents or overheating.

There are also requirements that are specific to the two Groups and three sub-Categories as well as additional requirements for safety related devices, for example they must be fail-safe. There are also requirements relating to systems such as hazards caused by power failure.

All equipment within the scope of ATEX must be marked and the directive specifies which markings are required and include the name and address of manufacturer, CE mark, year of construction, a specific marking of explosion protection and a symbol to represent the equipment Group and Category. Equipment in Group II is also marked G to signify gases and D for dusts.

4 How to comply

Manufacturers will need to submit an application for examination to an approved Notified Body. There are several procedures that can be used, a product "type" can be approved or an individual unit can be tested and approved by a Notified Body. For "type approval", the Notified body will review submitted information, examine and test the equipment and provide a certificate of conformity if the equipment meets all of the requirements. Manufacturers will also need to inform the Notified Body if any modifications are made and further testing may be required before approval can be given. However ATEX does not apply to repaired equipment as long as the original function is maintained.

The types of technical documentation that will be required includes:

- Design drawings, layout diagrams, circuit diagrams, etc.
- Description and explanations of drawings
- A list of standards which apply
- Test reports and any other information such as design calculations.
- Manufacturers should carry out risk assessments and many possible methods are available for this. The EC guidance suggests two methods; i) by a systematic review of all component parts and the likely effect of possible defects to these and ii) by the use of brain-storming. EC guidance also suggests that more than one technique should be used to avoid overlooking risks.



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COBHAM



For the World

Putting IECEx and ATEX together

For Europe

- Aim: One single certificate for any hazardous area product recognised and accepted throughout the world.
- Already accepted in many countries. Alternatively a single test report (ExTR) can be sent to any member certification body (ExCB) to issue locally accepted certification.
- Currently only electrical equipment to IEC Standards.
- ExCB issues an ExTR (covering the product type) and a quality assessment report (QAR) (covering the related production facility)
- Certificates of conformity created directly on the IECEx website, fully visible for the whole world to read and check status.
- ExCB maintains the status of certificate based on the outcome of further QARs, a minimum of 2 audit visits in a 3 year period.

IECEx
Product Certification

- Technically identical standards for electrical equipment since 2005. With the exception of intrinsic safety, where a revised IEC/EN 60079-11 and a new IEC/EN 61241-11 are due in 2006.
- For single standards, a single set of tests and assessments can support both IECEx and ATEX.
- An ATEX EC-Type Examination Certificate can be based on an IECEx ExTR but ATEX documentation does not necessarily support an IECEx certificate.
- The technical requirements of a manufacturer's QA system are effectively the same, both are based on EN13980 and an IECEx QAR can support the issue of an ATEX QAN.

ATEX
Conformity Assessment

- A common approach to lifting barriers to trade within the European Economic Area (EEA).
- The Directive becomes law on implementation in each member country and compliance is mandatory within the EEA.
- Applicable to non-electrical equipment and protective systems as well as electrical equipment.
- Certification from a Notified Body is Mandatory for cat. 1 and M1 equipment, protective systems and cat. 2 and M2 electrical equipment. Otherwise self-declaration of compliance is permitted.
- An EC-Type Examination Certificate and Quality Assessment Notification (QAN) are issued by a Notified Body.
- The manufacturer - alone - is responsible for the Declaration of Conformity which must accompany every product which bears the European CE Marking.

Electrical Protection Concepts

Standard IEC/EN	Code		Protection Concept	Zone	
	Gas	Dust		Gas	Dust
60079-0	61241-0		General Requirements		
60079-1		Ex d	Flameproof	1	
	61241-1	Ex tD	Enclosure		20/21/22
60079-2	61241-2	Ex p	Pressurised	1	21/22
60079-5		Ex q	Powder Filled	1	
60079-6		Ex o	Oil Filled	1	
60079-7		Ex e	Increased Safety	1	
60079-11(*)	61241-11(*)	Ex ia Ex iaD Ex ib Ex ibD	Intrinsic Safety	0	20 21
60079-15		Ex nA Ex nL Ex nR Ex nC Ex nP	Non-sparking Energy limited Restricted breathing Enclosed break Pressurisation	2	
60079-18	61241-18	Ex ma Ex mb	Encapsulation	0	20 21

Ingress Protection (IP)

Hazardous area equipment typically requires a minimum IP rating of IP54 but may be assessed and tested to the higher ratings below:

DUST
IP 5x - Dust protected
IP 6x - Dust tight

WATER
Protected against:
IP x4 - splashing water
IP x5 - water jets
IP x6 - powered water jets
IP x7 - temporary immersion
IP x8 - continuous immersion

See IEC/EN 60529 for full definition of IP ratings

Mechanical Protection Concepts

Standards	Code	Concept	Zone	Mechanical certification is based on a risk assessment approach.
EN13463-1		general requirements		Category 3 equipment must be safe for use in normal operation
EN13463-2	fr	flow restriction	2 22	Category 2 equipment must be safe for use in normal operation and expected malfunction
EN13463-3	d	flameproof	1 21	Category 1 equipment must be safe for use in normal operation, expected and rare malfunction
EN13463-5	c	constructional safety	1 21	Potential ignition sources identified in the risk assessment are made safe by applying one or more of the concepts. The number of "1" in the table below indicate the number of protection concepts which need to be applied.
EN13463-6	b	control of ignition sources	1 21	
EN13463-7	p	pressurisation	1 21	normal operation expected malfunction rare malfunction
EN13463-8	k	liquid immersion	1 21	normal operation expected malfunction rare malfunction

Temperature Class

T Class	Maximum Surface Temperature
T1	450°C
T2	300°C
T3	200°C
T4	135°C
T5	100°C
T6	85°C

- Gas Group
- Protection Concept
- Temperature Class
- Ingress Protection
- ATEX Coding

IECEx BAS05.0001X

Ex de IIB T4 -30°C < Td < 50°C

ABC Engineering
Buxton, SK17 9RZ, UK

Type XYZ Solenoid
2005 s/n 1234 IP65

240V ac 5A

IECEx Certificate No.

Ambient Range -20°C to 40°C unless stated on label

Manufacturer's Name and Address

Electrical Parameters

Product Identification

Serial No. and Year of Manufacture

ATEX Notified Body Identification No.

ATEX Certificate No.

Baseefa05ATEX0001X

Gas Groups

Gas Group	Representative Test Gas
I	Methane (mining only)
IIA	Propane
IIB	Ethylene
IIC	Hydrogen

Gases are classified according to the ignitability of gas-air mixtures. Refer to IEC/EN 60079-20 for classification of common gases and vapours.

ATEX User Directive - DSEAR Implementation

What does DSEAR require?

Employers must:

- find out what dangerous substances are in their workplace and what the fire and explosion risks are
- put control measures in place to either remove those risks or, where this is not possible, control them;
- put controls in place to reduce the effects of any incidents involving dangerous substances;
- prepare plans and procedures to deal with accidents, incidents and emergencies involving dangerous substances;
- make sure employees are properly informed about and trained to control or deal with the risks from the dangerous substances;
- identify and classify areas of the workplace where explosive atmospheres may occur and avoid ignition sources (from unprotected equipment, for example) in those areas

The following are just some of the standards that can assist in the implementation of DSEAR

EN 1127-1 Explosion prevention and protection
IEC/EN 60079-10 Classification of hazardous areas
IEC/EN 60079-14 Electrical installations hazardous areas
IEC/EN 60079-20 Data for flammable gases and vapours

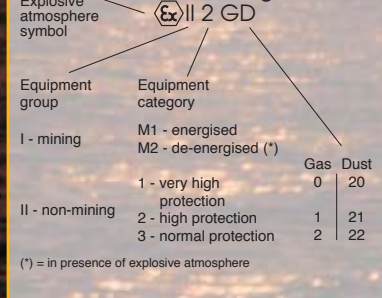
IEC 61508 - Safety Systems

IEC/EN 61508 is the international standard for electrical, electronic and programmable electronic safety related systems. It sets out the requirements for ensuring that systems are designed, implemented, operated and maintained to provide the required safety integrity level (SIL). Four SILs are defined according to the risks involved in the system application, with SIL4 being used to protect against the highest risks.

The standard is in seven parts:

IEC 61508-1, General requirements
IEC 61508-2, Requirements for E/E/PE safety-related systems
IEC 61508-3, Software requirements
IEC 61508-4, Definitions and abbreviations
IEC 61508-5, Examples and methods for the determination of safety integrity levels
IEC 61508-6, Guidelines on the application of IEC 61508-2 and IEC 61508-3
IEC 61508-7, Overview of techniques and measures

ATEX Coding



- Baseefa Services**
- ATEX certification
 - IECEx certification
 - IEC 61508 certification
 - Quality system approval
 - Assistance with DSEAR (ATEX User Directive) Implementation
 - Training
 - Technical advice
 - Technical file storage
 - Testing

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ATEX Identification



Scope of use:

Operating devices which are certified in accordance with directive 94/9/EG (ATEX 95 - previously ATEX 100a) are labelled with additional information which describes the place of installation or use. The device group appears first, then the device category and finally the atmosphere reference: (G)as and/or (D)ust.

The following categorisation applies to device group II:

Category 1 - very high level of safety

Safety is provided via 2-fold protection measures - even for rarely occurring equipment faults or 2 independent equipment faults.

Use in zone 0, 1, 2 / 20, 21, 22, atmosphere G / D

Labels for the avoidance of explosions - required in accordance with Directive 94/9/EC

(General regulations for the design and testing of electrical operating equipment for use in Ex-proof areas)

Category 2 - higher level of safety

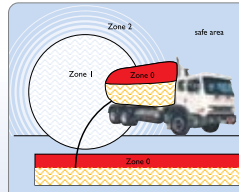
adequate safety for frequent equipment faults / 1 fault

Use in zone 1, 2 / 21, 22, atmosphere G / D

Category 3 - normal level of safety

adequate protection during fault-free operation

Use in zone 2 / 22, atmosphere G / D



Division into zones

Safety plays a particularly important role wherever flammable substances are manufactured, processed, transported or stored - especially in the chemical and petrochemical industries, in crude oil and natural gas transportation and in the mining industry. In order to guarantee high levels of safety in these areas, legislators in most countries have drawn up corresponding requirements in the form of legislation, directives and standards. One aspect of globalisation has been the great progress which has been made in terms of standardising the directives for explosion protection. The European Union plays a leading role here: Directive 94/9/EC creates the basis for complete harmonisation, as since July 1, 2003 all new equipment destined for the European market must be approved according to this directive.

Definition of the zone classification:

Zone 0 / 20: Hazard: constant, prolonged or frequent	Device category I
Zone 1 / 21: Hazard: occasional	Device category 2
Zone 2 / 22: Hazard: rare and temporary	Device category 3

Explosion group

This designation section contains among other things the device group. **Group I** comprises operating devices for fireproof mining with prevailing coal dust and methane atmospheres. **Group II** applies to all areas above ground, such as chemical or petrochemical plants, mills (dusts) etc. The "intrinsically safe", "flameproof enclosure" and "powder filling" types of ignition protection are further divided into explosion groups: **IIA** to **IIC** due to the different igniting power of the various gases.

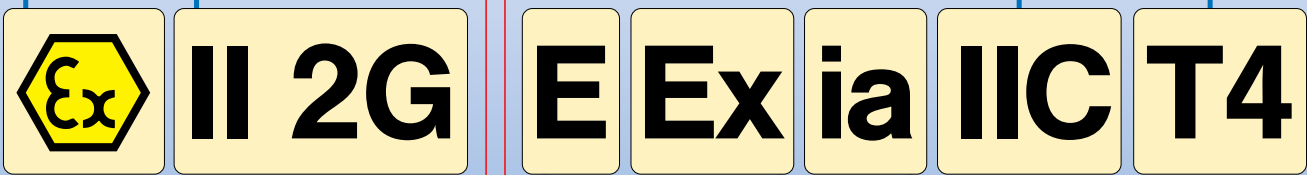
GENELEC Identifier	Typical Gas	Ignition Power μJ
I	Methane	280
IIA	Propane	>180
IIB	Ethylene	60 - 180
IIC	Hydrogen	<60

Temperature classes

Due to their different ignition temperatures, gases are classified in temperature classes. Similarly, the electrical operating devices in **Group II** are classified according to the maximum surface temperature which can be reached by the ex-atmosphere.

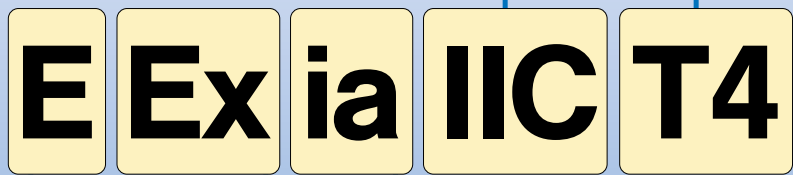
Max. permissible housing or component temperature of the operating devices

T1	450°C
T2	300°C
T3	200°C
T4	135°C
T5	100°C
T6	85°C

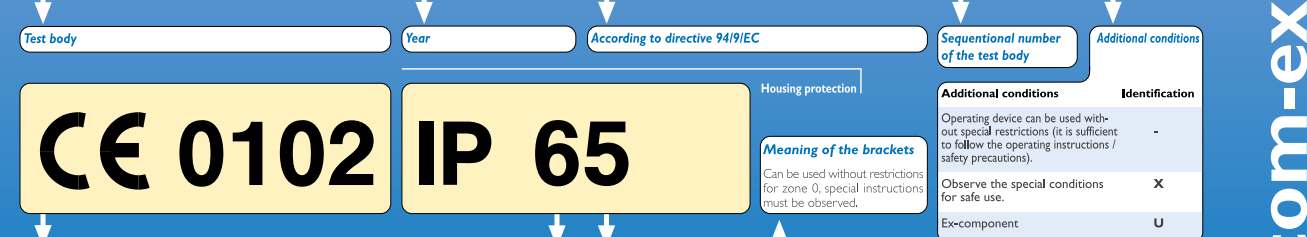
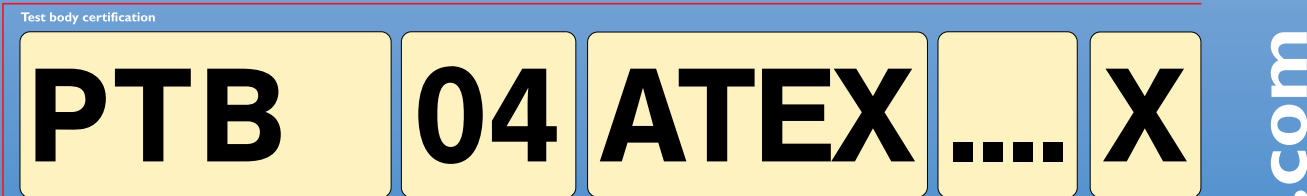


Additional identification in accordance with directive 94/9/EC (ATEX 95)

Identification in accordance with EN 60079-0



Type of ignition protection	Explosion protection Fundamentals and methodology	General requirements	Special requirements for operating materials in Group II, Category I in a gaseous atmosphere	Intrinsic safety	Encapsulation	Increased safety	Oil immersion	Overpressure encapsulation	Powder filling	Pressure-proof housing	Ignition protection type „n“*	General requirements	Protection based on the housing (dust atmosphere)
Symbol			Zone 0								Zone 2		
Identification				Ex i	Ex m	Ex e	Ex o	Ex p	Ex q	Ex d	Ex n		New: Ex tD Old: Tx, C, P, X
Basic principle	Special information for zone 0: Surface temperatures must not exceed 80% of the ignition temperature of the gas, even under rarely occurring operational faults. (Also contains further information about temperature safety distances for "dust Ex-areas".)	General regulations for the design and testing of electrical operating equipment for use in Ex-proof areas.	Ex ia or Ex ma or suitable combination of two independent types of ignition protection Safety - even if two independent faults occur or - on failure of an apparatus-based protection measure by means of a second independent protection measure	Prohibited high temperatures, sparks and electric arcs are prevented by limiting the energy in the circuit. Detailed information: * = use in zone I, II, III; o = oil; under consideration of further standards; m = see in group II, 2* (depending on the device category)	Ignition of the atmosphere is prevented by bedding the ignition source in a sealing compound. Detailed information: m = use in zone II, III; o = oil; under consideration of further standards; m = see in group II, 2* (depending on the device category)	Only applies to operating devices or their components which, under normal circumstances, do not generate sparks or electric arcs, do not develop dangerously high temperatures and do not exceed a rated voltage of 11 kV.	Operating devices or components thereof are enclosed in oil and hence isolated from the Ex-atmosphere.	The ignition source is enclosed by a pressurised ignition protection gas through which the surrounding atmosphere cannot penetrate.	The ignition source is enclosed with fine-grained sand surrounding the housing cannot be ignited by for example an electric arc.	If an ignition takes place in the interior of the capsule then the housing will withstand the pressure - the explosion is not transmitted to the outside.	Slightly simplified application of the other types of ignition protection. Devices in this category guarantee the required level of protection during normal operation. * = non-sparking electrical operating devices n = dust-protected contacts d = apparatus with protected contacts t = apparatus with proof housing D = operating devices and circuits with reduced energy 2 = operating device with overpressure encapsulation	General requirements for the design, construction, testing and identification of operating devices for use in "dust Ex-areas".	Use of a dust-protected or dust-proof housing with a limited max. surface temperature * IP 5x only for non-conducting dusts
Use (zone)			0, I and 2	0, I or 2	0, I or 2	I or 2	I or 2	I or 2	I or 2	I or 2	2		20, 21 (IP 6x) 22 (IP 6x, IP 5x possible!)
Standard old	EN 1127-1	EN 50014	EN 50284	EN 50020	EN 50028	EN 50019	EN 50015	EN 50016	EN 50017	EN 50018	EN 50021		EN 50281-1
Standard new		EN 60079-0		EN 60079-11	EN 60079-18	EN 60079-7	EN 60079-6	EN 60079-2	EN 60079-5	EN 60079-1	EN 60079-15	EN 61241-0	EN 61241-1
	General	Gas atmosphere										Dust atmosphere	



Test bodies in Europe (selection)

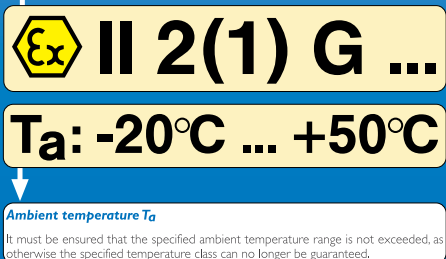
Test body	Body	Identification
PTB	Germany	0102
ZELM	Germany	0820
EXAM	Germany	0158
TÜV Product Service GmbH	Germany	0123
IBExU	Germany	0637
KEMA	Netherlands	0344
UL INTERNATIONAL DEMKO A/S	Denmark	0539
NEMKO	Norway	0470
Baseefa	United Kingdom	1180

Foreign body protection

0	1	2	3	4	5	6
No protection	Objects > 50 mm	Objects > 12,5 mm	Objects > 2,5 mm	Objects > 1,0 mm	Dust Protected	Dust Tight

Water protection

0	1	2	3	4	5	6	7	8
No protection	Vertically Dripping Water	75° to 90° Angled Dripping Water	Sprayed Water	Splashed Water	Water Jets	High Power Water Jets/Heavy Seas	Effects of Immersion	Indefinite Immersion



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