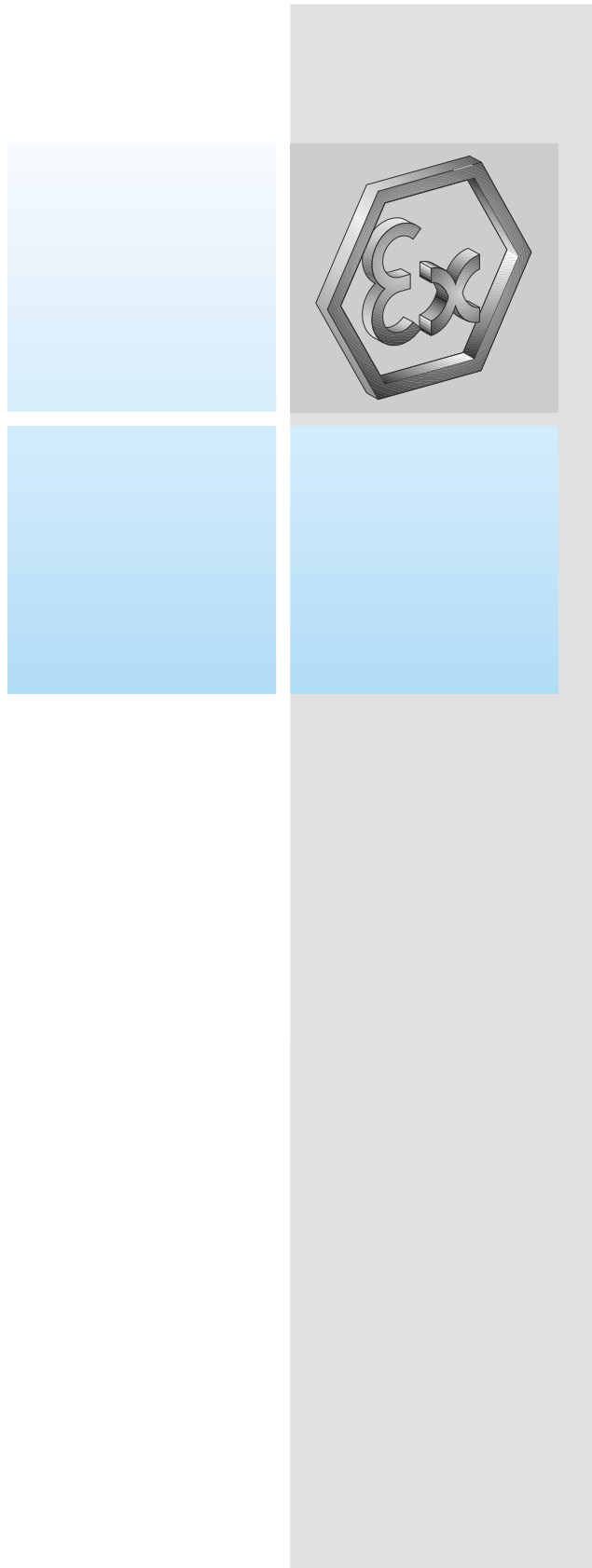


Regulations and Information on Explosion-Protection



Regulations and Information on Explosion-Protection



Regulations on Explosion-Protection:

Electrical apparatus for use in hazardous areas must be explosion-protected in design and must comply with the regulations on Explosion-Protection. In order to establish a requirement and safety level that is the same throughout Europe, the EC Commission has compiled product-related "European Directives" for all types of products.

In 1975 the Council of the European Community issued basic directives on Explosion-Protection. These were converted into national law in Germany in the "Regulations concerning electrical installations in explosive atmospheres (Elex V)" issued in February 1980. CENELEC, the European committee for electrotechnical standardization, worked out European standards for apparatus for use in hazardous areas. These standards DIN EN 50014 to 50020/VDE 0170/0171, Parts 1 to 7, designated as VDE regulations, came into force on 1.5.1978. They contain constructional and test requirements for explosion-protected electrical apparatus for Zone 1.

The certificates of conformity or inspection certificates issued by notified bodies of member states of the EC, which are issued on the basis of the tests carried out, are recognized by all member states of the European Union as type examination certificates.



Explosion-protected apparatus according to the directive 76/117/EEC bear the **Ex-symbol**.

After a transition period, as of July 1, 2003 the **directives 94/9 EC of the European Parliament and Council for the harmonization of the statutory provisions of member states on apparatus and protective systems intended for use potentially explosive atmospheres** dated 23.3.1994 (**directive 94/9/EC**) will replace any existing directives on Explosion-Protection on a European level.

This new Ex-directive was converted into national German law by the new "**Explosion-Protection decree (ExVO)**" issued in December 1996.

Parallel to this, a revised version of the "**Regulations concerning electrical installations in explosive atmospheres (ElexV)**" was also issued in December 1996.

Among other things, the new ATEX directive newly regulates the classification and marking of apparatus for use in hazardous areas. Apparatus is now classified as:

Apparatus for mining

operations:

Apparatus Group I

Apparatus for use in all other

hazardous areas:

Apparatus Group II

This is divided further into apparatus categories that regulate the safety level of the apparatus for the respective zone:

Categories 1, 2 and 3

In addition to this, distinction is also made between apparatus for use in **hazardous areas due to the presence of explosive gases, vapours or mists**, code letter "G", and apparatus for use in **hazardous areas due to the presence of dust**, code letter "D".

Apparatus for hazardous areas with the presence of explosive gases, vapours or mists

Zone	Apparatus category	Marking
0	1	II 1 G
1	2	II 2 G
2	3	II 3 G

Apparatus for use in hazardous areas caused by dust

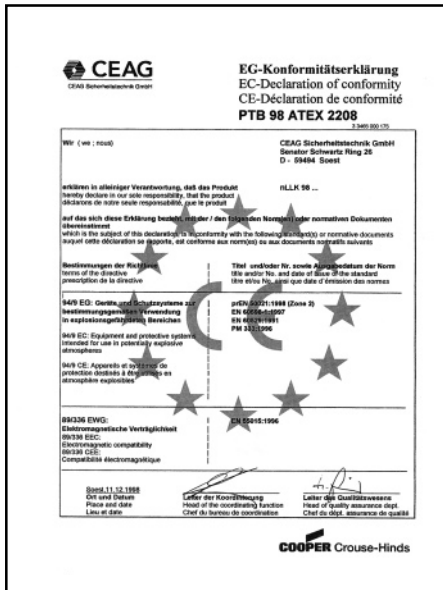
Zone	Apparatus category	Marking
20	1	II 1 D
21	2	II 2 D
22	3	II 3 D

After successful completion of the type test within the scope of the conformity evaluation procedure, the authorized testing stations, now called **notified bodies**, issue an "**EC Type Examination Certificate**".

The majority of the products in this catalogue have already been certified in accordance with the new Explosion-Protection directive ATEX 100a or a certificate has been applied for.

All the explosion-protected CEAG apparatus in this catalogue complies with the European standards EN 50014 to EN 500128 and can, therefore, be used in almost every country on earth.

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To fulfil all requirements of the Explosion-Protection directive 94/9/EC (as well as of any further EC-directives which is applicable), the manufacturer issues an **“EC Declaration of Conformity”**.

To allow free movement of goods throughout Europe, the **CE marking**



shall be affixed to all apparatus to which this EC declaration of conformity applies.

Hazardous areas due to the presence of explosive gases, vapours and mists

Hazardous areas due to the presence of explosive gases, vapours and mists are classified into three zones. This classification depends on the probability of the occurrence of an explosive gas atmosphere.

What electrical apparatus may be used in the individual zones?

Zone 0 covers areas in which an explosive atmosphere caused by a mixture of air and gases, vapours or mists is present **continuously, for long periods or frequently**. Zone 0 mainly encompasses the areas inside closed containers, pipelines and apparatus which contain inflammable liquids. The respective operating temperature lies above the flash point. The hazardous area is above the liquid level and not within the liquid.

With **apparatus in the category 1 G** (for Zone 0), in order to avoid ignition hazards resulting from electrical circuits of the apparatus, it is necessary to guarantee the specified degree of safety

- in the event of two independent faults when only one protection measure is applied, or
- in the event of the failure one protection measure, by means of a second, independent protective measure.

These conditions are deemed fulfilled if, for example, the apparatus

- is designed in the type of protection “ia” to EN 50020, or
- intrinsically safe apparatus to “ib” is also potted according to EN 50028.

The requirements on apparatus with regard to electrostatic charges are considerably higher than those for Zone 1 or Zone 2.

The constructional and testing requirements for electrical apparatus in apparatus Group II 1 G have been newly regulated in Europe. EN 50284 / VDE 0170/0171, Part 12 replaces special national arrangements as defined by the ATEX directive.

Zone 1 covers areas in which the **occasional** occurrence of an explosive atmosphere due to the presence of gases, vapours or mists is likely.

Inflammable or explosive substances are made, processed or stored in Zone 1. This includes the area surrounding charging doors, the immediate vicinity of filling and emptying devices, the immediate vicinity of fragile equipment and lines, as well as around cable glands on pumps and slides that do not seal adequately. The occurrence of an explosive atmosphere is likely during normal operation.

With apparatus of the category 2 G (for Zone 1), it is either necessary to ensure that the occurrence of an ignition source is excluded, or the ignition source must be encapsulated by a recognized type of protection in such a way that the ignition of an explosive atmosphere surrounding the apparatus is prevented. This applies in Zone 1 for both normal, trouble-free operation and for the operating faults that commonly occur. The constructional and test regulations for the permissible types of protection are laid down in EN 50014 ff. The table on page 0/6 is a comparison of these types of protection for Zone 1 apparatus.

Zone 2 covers areas in which the occurrence of an explosive atmosphere due to the presence of gases, vapours and mists is not likely, but if one should occur, then **only rarely** and **only for a short period**.

Zone 2 encompasses areas around Zones 0 and 1 and areas around flanged joints of pipelines in closed rooms. Furthermore, it includes areas in which, due to natural or forced ventilation, the lower explosion limit is reached in exceptional cases only, e.g. the surroundings of outdoor installations.

Inflammable or potentially explosive materials are made and stored in Zone 2. In such a way that the probability of the occurrence of an explosive atmosphere is rare, and then only for a short time.

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With such dust explosion-protected apparatus, there are, among other things, given surface temperatures and minimum IP degrees of protection required.

The approval amendments for dust Explosion-Protection in accordance with directive 94/9/EC are already available for many of the explosion-protected light fittings and apparatus in this catalogue, or they have been applied for.

Classification of apparatus

In accordance with the various properties of gases with regard to ignition temperature, ignition capability and flame transmission capacity, explosion-protected electrical apparatus is divided into explosion groups and temperature classes.

Division of explosion-protected apparatus into explosion groups

To specify the scope of application of explosion-protected electrical apparatus, it is sub-divided into two groups:

Group I: Electrical apparatus for use in mines susceptible to the hazard of firedamp

Group II: Electrical apparatus for use in all other hazardous areas

A further sub-division of the Explosion Group II into "A", "B" and "C" is prescribed for the types of protection "flameproof enclosure" and "intrinsic safety".

With the type of protection "flameproof enclosure" this sub-division is made according to the maximum experimental safe gap for the non-transmission of an internal ignition (MESG), whereas with the type of protection "intrinsic safety" this sub-division is made according to the ratio of the minimum ignition current of the mixture being tested to the minimum ignition current of a mixture of laboratory methane and air (MIC). Group II C apparatus is suitable for use in all types of gas atmospheres.

Division of explosion-protected apparatus into temperature classes

The ignition temperature is the lowest temperature of a surface at which an explosive atmosphere will ignite.

Gases and vapours can be divided into temperature classes according to their ignition temperatures. This results in a sub-division of explosion-protected electrical apparatus into the temperature classes T1 to T6. This classification allows explosion-protected apparatus to be used economically.

The maximum surface temperature of an apparatus must always be lower than the ignition temperature of the gas/air or vapour/air mixture.

Generally speaking, explosion-protected apparatus must be suitable for an ambient temperature from -20 °C to +40 °C.


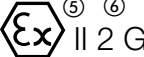

The following tables show both the division of explosion-protected apparatus according to the temperature classes and examples of the classification of gases and vapours in accordance with the explosion groups and temperature classes.

Temperature class	Max. surface temperature
T1	450 °C
T2	300 °C
T3	200 °C
T4	135 °C
T5	100 °C
T6	85 °C




Classification of gases and vapours into explosion groups and temperature classes

	T 1	T 2	T 3	T 4	T 5	T 6
I	Methane					
II A	Acetone, Ethane, Ethylacetate, Ammonia, Benzol, Acetic acid, Carbonmonoxide, Methanol, Propane, Toluene	Ethylalcohol i-amylacetate n-butane n-butylalcohol	Petrol Diesel-fuel Aviation-fuel Heating-oils, n-hexane	Acetaldehyde Ethyl-ether		
II B	Town gas (lamp gas)	Ethylene				
II C	Hydrogen	Acetylene				Carbondisulphide

Regulations and Information on Explosion-Protection

 CEAG eLLK 92036/36 CEAG Sicherheitstechnik GmbH, Senator-Schwartz-Ring 26, 59494 Soest		
S. Nr.: D123456	2000	 
PTB 96 ATEX 2144		110-254 V 50-60 Hz
EEx ed IIC T4		110-230 V DC
Lampe: G13-81-IEC-1305-2		Ta ≤ 50 °C

Type label according to new directive 94/9/EC

 CEAG eLLK 92036/36 CEAG Sicherheitstechnik GmbH		
PTB Nr. Ex-92.C.1801 X		 
EEx ed IIC T4		110-254 V 50-60 Hz
Lampe: G13-IEC-1305-2		110-230 V DC
Ser. Nr.: D189115		Tu ≤ 50 °C

Type label according to previous directive

Marking of explosion-protected apparatus

As, until the transition period expires, both the previous basic Explosion-Protection directive 76/117/EEC, supplemented by the individual Explosion-Protection directive 79/196/EEC, and the new Explosion-Protection directive 94/9/EC are valid, there are two valid parallel certification procedures and marking methods for explosion-protected apparatus.

By way of example, the two type labels for an explosion-protected light fitting for fluorescent lamps show both the marking according to the previous directive and the marking according to the new directive.

- ① Name / Code of manufacturer
- ② Type code
- ③ Address of manufacturer
- ④ Year of manufacture
- ⑤ Community marking for explosion-protected apparatus in accordance with directive 76/117/EEC
- ⑥ Marking of apparatus in accordance with directive 94/9/EC:
 for use in hazardous areas: **II**
 apparatus Group II for use in Zone 1 areas
 category: **2**
 for use in gas hazardous areas: **G**
- ⑦ CE marking confirming conformity with all requirements of the applicable directives for the product. The number next to the CE marking (only typical for ATEX) stands for the notified body involved in the production quality system (in this case PTB)
- ⑧ Testing station (notified body) and number of certificate ("X" after number means that special conditions must be observed)
- ⑨ Marking of apparatus in accordance with the European Standards for the construction and testing of explosion-protected apparatus:
EEx: built and tested according to the European Standards
e d: types of protection used according to the European Standards
II C: explosion group
T 4: temperature class
- ⑩ Serial number
- ⑪ Technical data

Regulations and Approvals Outside the EC Jurisdiction

Outside the jurisdiction of directive 94/9/EC (EC area) there are other standards and approvals that apply for the operation of electrical apparatus for use in hazardous areas.

National approvals on the basis of the EN directives

The majority of the eastern European countries such as Russia, Poland, Hungary, etc. have their own certification bodies that issue their own approvals on the basis of the current EC type examination certificates. These are requisite for the installation and operation of electrical apparatus in hazardous areas in these countries. CEAG Sicherheitstechnik GmbH is in possession of approvals for the products listed in this catalogue in many of these countries. Details of this can be found at the beginning or end of the product chapter.

Non-European approvals

In addition to the EN standard, the IEC, as a worldwide standard, is an important basis for the approval of explosion-protected apparatus. A comparison shows the similarity of content to the European standards. Thus, almost all of the IEC standards can be compared to EN standards that say the same or are similar in content.

Approvals to the **“Australian Standard AS ...”** can, for example, be classed with the IEC circle.

Explosion-Protection in North America

The IEC/EN approach to Explosion-Protection differs to the engineering practices in North America. Here, to name one example, they use closed conduit systems with potted ignition barriers. Other criteria also apply for the classification. In addition to the “hazardous (classified) locations” **Class I** (gases, vapours and mists), there are **Class II** (dusts) and **Class III** (fibres). These design regulations and classifications are laid down in the NEC regulation, Sections 500 to 505, valid for the USA, and in the CEC standard, Section 18, valid for Canada. In addition to this the areas are divided into Division 1 and Division 2.

Due to the introduction of the IEC zone classification concept in Canada in 1988 and in the USA in 1996 (amendment of NEC, Article 505 and of CEC), the use of a comparable technology became possible.

Table of Comparison of Types of Protection

Type of Protection	EN Standards	IEC Standards
General requirements	EN 50014	IEC 60 079-0
Increased safety „e“	EN 50019	IEC 60 079-7
Flameproof enclosure „d“	EN 50018	IEC 60 079-1
Intrinsic safety „i“	EN 50020	IEC 60 079-11
Oil immersion „o“	EN 50015	IEC 60 079-6
Pressurization „p“	EN 50016	IEC 60 079-3
Powder filling „q“	EN 50017	IEC 60 079-5
Encapsulation „m“	EN 50028	IEC 60 079-18
Type of protection „n“	EN 50021	IEC 60 079-15

Table of Comparison – IEC - NEC - CEC Classification

	Gases, vapours or mists Class I	Dusts Class II	Fibres Class III
Regulation USA Regulation Canada	NEC 500-5 CEC J18-004	NEC 505-7 CEC 18-006	NEC 500-6 CEC 18-008
Classification	Division 1 Division 2	Zone 0 Zone 1 Zone 2	Division 1 Division 2
Group (Groups to NEC 500 .. or CEC J18-050)	- 3	- 7	- 3
Temperature classes Class I	Div. 1 and 2 A (acetylene) B (hydrogen) C (ethylene) D (propane)	Zone 0, 1, 2 II C (acetylene, hydrogen) II B (ethylene) II A (propane)	Div. 1 and 2 --- E (metals) F (coals) G (grain)
	Div. 1 and 2 T1 ≤ 450 °C T2 ≤ 300 °C T2A ≤ 280 °C; T2B ≤ 260 °C T2C ≤ 230 °C; T2D ≤ 215 °C T3 ≤ 200 °C; T3A ≤ 180 °C T3B ≤ 165 °C; T3C ≤ 160 °C T4 ≤ 135 °C; T4A ≤ 120 °C T5 ≤ 100 °C T6 ≤ 85 °C	Zone 0, 1 and 2 T1 ≤ 450 °C T2 ≤ 300 °C T3 ≤ 200 °C T4 ≤ 135 °C T5 ≤ 100 °C T6 ≤ 85 °C	Div. 1 and 2 T1 ≤ 450 °C T2 ≤ 300 °C T2A ≤ 280 °C; T2B ≤ 260 °C T2C ≤ 230 °C; T2D ≤ 215 °C T3 ≤ 200 °C; T3A ≤ 180 °C T3B ≤ 165 °C; T3C ≤ 160 °C T4 ≤ 135 °C; T4A ≤ 120 °C T5 ≤ 100 °C T6 ≤ 85 °C

Chemical Stability of Plastics for Explosion-Protected Apparatus

Nowadays explosion-protected electrical apparatus is often made in the economical type of protection "increased safety". This calls for the use of high-grade, specially selected and tested plastics that meet the high requirements and provide a high mechanical, thermal and chemical stability.

The plastics listed in the table beside have been used in practice for years and have proved to be reliable.

The table beside gives details issued by the manufacturers of the plastics relating to the chemical stability of the plastics listed compared to a series of media.

These details can, however, only be applied up to a degree for the evaluation of the usability of explosion-protected electrical apparatus in chemical and petrochemical installations, as the aggressive atmosphere often only occurs for a short time and in a relatively low concentration.

Material	Polyamide	Polyester	Polycarbonate
Acetone	+	+	-
Ethyl alcohol (up to 30 %)	O	+	0,96 %
Ethyl glycol	O	+	+
Ammonia (at 23 °C)	+	+ 10 %	-
Benzene 60/140 °C	+	+	+
Benzol (at 23 °C)	+	+	-
Boric acid 3 %	+	+	+
Butane	+	+	+
Chlorine bleaching solution	O	+	
Chloric gas (damp)	O	+	-
Chloride of lime	O	+	+
Chromic acid 10 %	-	+	+
Cyclohexane	+	+	+
Diesel oil	+	+	+
Jet fuel	+	+	+
Acetic acid (up to 25 %)	O	+	+ 10 °C
Formaldehyde	+	+	+
Glycol	+	+	+
Glycerine	+	+	+
Uric acid (up to 20 %)	+	+	+
Fuel oil	+	+	+
Machinery oil	O	+	+
Sea water	+	+	+
Methyl alcohol	O	+	O
Lactic acid, conc. 20 %	+	+	+
Mineral oil	+	+	
Sodium chloride	O	+	+
Soda lye (20 - 25 °C)	+	+ 5 %	-
Petroleum	+	+	-
Phosphoric acid, conc.	-	+	+
Soap suds (at 23 °C)	+	+	+
Sulphuric acid 5 - 30 % and 70 %	O	+	+
Sulphuric dioxide, dry (at 23 °C)	+	+	O
Super fuel (up to 60 °C)	+	+	-
Turpentine (at 23 °C)	+	+	-
Tartaric acid	O	+	+ up to 10 %
Citric acid up to 32 %	+	+	+

Explanation of symbols:

+ = stable O = limited stability - = non-stable