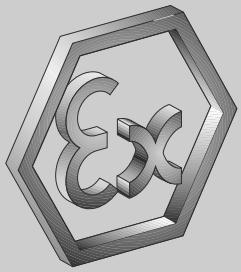
Regulations and Information on Explosion-Protection



Regulations and Information on Explosion-Protection

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

CONFORMITY STATEMENT
(Translation)

(1)
(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - Directive 94/9/EC
(3) Test Certificate Number:

PTB 98 ATEX 2208

(4) Equipment: Luminaire with fluorescent lamps type nLLK98 ...
(5) Manufacturer: CEAG Sicherheitstechnik GmbH
(6) Address: Senator-Schwartz-Ring 26, D-59494 Soest
(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.
(8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.
The examination and test results are recorded in the confidential report PTB Ex 98-28520.
(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with: prEN 50 021:1998
(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.
(11) This Conformity Statement relates only to the design and construction of the specified equipment in accordance with Directive 94/9/EC. Further requirements of this Directive apply to the manufacture and supply of this equipment.
(12) The marking of the equipment shall include the following:
Ex II 3 G EEx nA II T4

Zertifizierungsstelle Explosionsschutz
By order:
Braunschweig, December 8, 1998
Dr.-Ing. U. Johannmeyer
Regierungsdirektor

Sheet 1/2

Conformity Statements without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt.
In case of dispute, the German text shall prevail.
Physikalisch-Technische Bundesanstalt • Bundesallee 100 • D-38116 Braunschweig

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.

Regulations and Information on Explosion-Protection

CEAG

EG-Konformitätserklärung
EC-Declaration of conformity
CE-Déclaration de conformité
PTB 98 ATEX 2208

COOPER Crouse-Hinds

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**

CE

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.

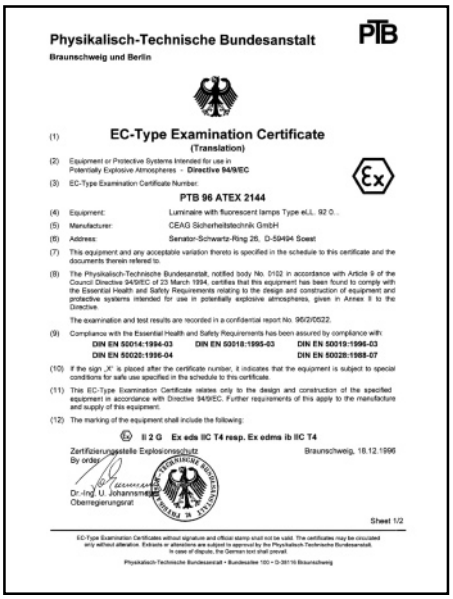
Zone 1 covers areas in which the **occasional** occurrence of an explosive atmosphere due to the presence of gases, vapours or mists is likely.

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.

Regulations and Information on Explosion-Protection



Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

(1) **EC-Type Examination Certificate**
(Translation)

(2) Equipment or Protective Systems Intended for use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-Type Examination Certificate Number:
PTB 96 ATEX 2144

(4) Equipment: Luminaire with fluorescent lamps Type eLL 92 0...

(5) Manufacturer: CEAG Sicherheitstechnik GmbH

(6) Address: Senator-Schwartz-Ring 26, D-59494 Soest

(7) This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in a confidential report No. 96/2/0622.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:
DIN EN 50014:1994-03 **DIN EN 50018:1995-03** **DIN EN 50019:1996-03**
DIN EN 50020:1996-04 **DIN EN 50028:1988-07**

(10) If the sign „X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-Type Examination Certificate relates only to the design and construction of the specified equipment in accordance with Directive 94/9/EC. Further requirements of this apply to the manufacture and supply of this equipment.

(12) The marking of the equipment shall include the following:
Ex II 2 G Ex eda IIC T4 resp. Ex edma ib IIC T4

Zertifizierungsstelle Explosionsschutz
By order:
Dr.-Ing. U. Johannsmeier
Oberregierungsrat

Braunschweig, 18.12.1996

Sheet 1/2

EC-Type Examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt.
In case of dispute, the German text shall prevail.
Physikalisch-Technische Bundesanstalt • Bundesallee 100 • D-38116 Braunschweig

Apparatus in the category 3 G (Zone 2) must be designed in such a way that it is safe during normal, trouble-free operation. All apparatus that fulfils the requirements for Zone 0, Zone 1 and Zone 2 may be used. The require-ments for electrical apparatus specially designed for use in Zone 2 have been newly regulated in EN 50021. In future the previous practice of also using apparatus of "good industrial quality" in Zone 2, a common practice in some countries, will not be possible without additions. Zone 2 apparatus to EN 50021 provides a level of protection that is considerably higher than that of standard industrial apparatus.
Similarly, in the new standard , the requirements for Zone 2 apparatus according to previous national standards are considerably higher.

The type of protection "n" applies for Zone 2 apparatus: apparatus that cannot ignite a surrounding explosive atmosphere under normal and certain abnormal operating conditions.
In addition to this, distinction is made between apparatus that does normally not produce arcs/ sparks and/or hot surfaces **"non-sparking apparatus"** and apparatus that produce sparks/ arcs and/or hot surfaces **"sparking apparatus".**
The Explosion-Protection methods resulting from this were derived, in part, from the types of protection for Zone 1/category 2 apparatus, whereby they were adapted for Zone 2/category 3 apparatus on a lower level.

Non-sparking apparatus "nA":
The risk of the occurrence of sparks/arcs and/or hot surfaces during normal operation is mini-mized by constructional measures.

Sparking apparatus:
Here sparks/arcs and/or hot surfaces occur during normal operation: The following protection methods are permissible:

Apparatus with protected contacts: **"nC"**
This includes enclosed switchgear, non-ignitable components, hermetically sealed, sealed and encapsulated devices.
Restricted breathing apparatus: **"nR"**
Apparatus with simplified pressurization: **"nP"**
Limited power apparatus: **"nL"**

Hazardous areas due to the presence of dust/air mixtures:
Hazardous areas due to the presence of inflammable dust/air mixtures are also subdivided into 3 zones that are comparable to the zones for explosive gas atmospheres.

Zone 20 covers areas in which an explosive atmosphere due to dust/air mixtures is present **continuously, for long periods or frequently.**

If these conditions occur, they are usually found in closed containers, pipelines, apparatus, etc.

Zone 21 covers areas in which the occurrence of an explosive atmosphere due to dust/air mixtures is to be expected **occasionally.**

This can, for e/xample, include areas in the immediate vicinity of dust extraction or filling stations and areas where dust deposits can occur and can form a potentially explosive concentration of inflammable dust mixed with air under normal operating conditions.

Zone 22 covers areas in which the occurrence of an explosive atmosphere due to whirled-up dust is not likely, but, if it occurs, then in all probability **only rarely** and **only for a short period.**

This can, for example, include areas in the vicinity of apparatus containing dust if dust can escape from leaks.

In future only apparatus that fulfils the conditions of the directive 94/9/EC shall be used in these areas. Electrical apparatus in the type of protection "dust Explosion-Protection due to enclosure" must be built and tested in accordance with EN 50028-1-1, whereby, for the most part, this was based on the general requirements in accordance with EN 50014 for explosion-protected apparatus for gases, vapours and mists.

Regulations and Information on Explosion-Protection

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.

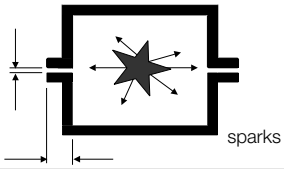
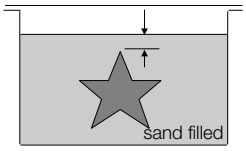
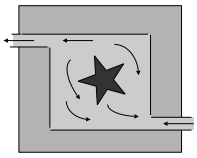
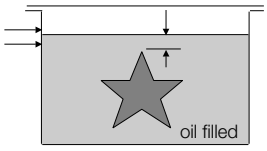
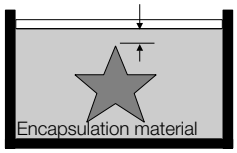
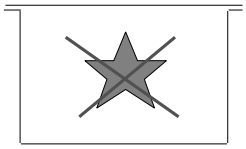
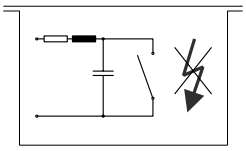
Temperature class	Max. surface temperature
T1	**450 °C**
T2	**300 °C**
T3	**200 °C**
T4	**135 °C**
T5	**100 °C**
T6	**85 °C**

Classification of gases and vapours into explosion groups and temperature classes

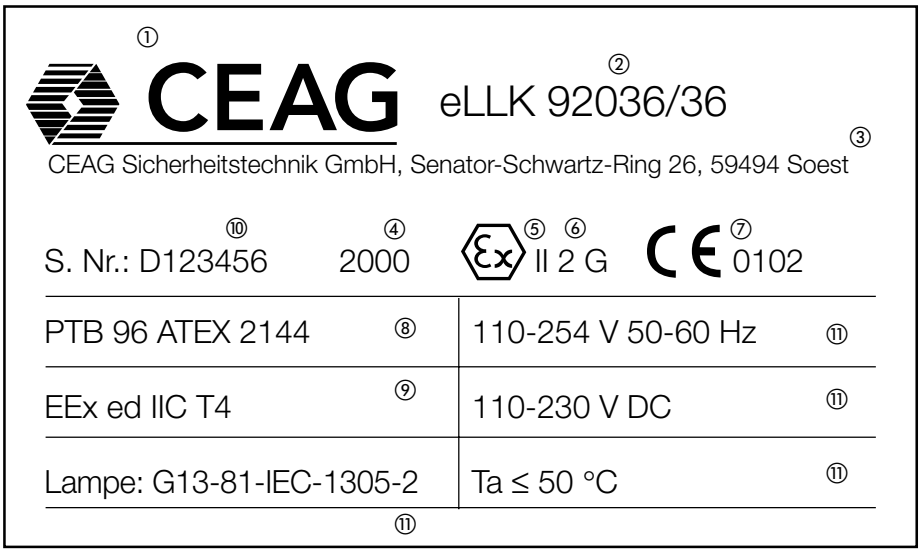
	T 1	T 2	T 3	T 4	T 5	T 6
I	Methane					
II A	Acetone, Ethane, Ethylacetate, Ammonia, Benzol, Acetic acid, Carbonmonoxide, Methanol, Propane, Toluene	Ethylalcohol i-amylacetate n-butane n-butylalcohol	Petrol Diesel-fuel Aviation-fuel Heating-oils, n-hexane	Acetaldehyde Ethyl-ether		
II B	Town gas (lamp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

Regulations and Information on Explosion-Protection

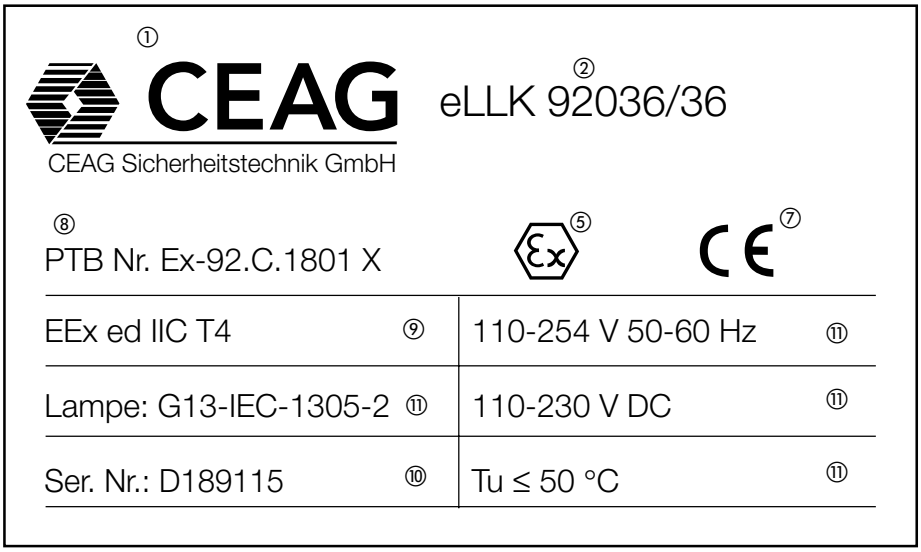
Types of Protection according to European Standard

Type of Protection	Symbols	IEC/EN	Principle	Applications
Flameproof enclosure	d	IEC 60079-1 EN 50018		Power-operated apparatus, switchgear, motors (all types of apparatus producing ignitable arcs in normal operation)
Sand filling	q	IEC 60079-5 EN 50017		Capacitors, electronic components, fuses
Pressuri-zation	p	IEC 60079-2 EN 50016		Power-operated apparatus (active safety measures required)
Oil immersion	o	IEC 60079-6 EN 50015		Transformers (rarely used)
Encap-sulation	m	IEC 60079-18 EN 50028		Measurement and control devices, relays, electronic circuits
Increased safety	e	IEC 60079-7 EN 50019		Connection and distribution boxes, light fittings, measuring instruments, squirrel cage motors (no ignitable sparks in normal operation)
Intrinsic safety	i	IEC 60079-11 EN 50020		Measurement and control devices, data processing (low electric values)

Regulations and Information on Explosion-Protection



Type label according to new directive 94/9/EC



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 Information on Explosion-Protection

Degrees of protection in accordance with EN 60529

Because they are often used in outdoor installations and often come into contact with dust and water, as well as with other environmental influences caused by chemical media, explosion-protected electrical apparatus are subjected to particularly extreme operating conditions. In accordance with the constructional and test requirements explosion-protected apparatus must, therefore, satisfy the requirements for a minimum degree of protection, normally **IP 54.** The IP degrees of protection according to EN 60529 are defined according to the protection against inadvertent contact, foreign matter and water.

The degrees of protection against solid foreign matter are designated by the first code number

Degrees of protection against water are designated by the second code number

Example: **IP 65:** dust-tight, protected against jet water

First Number	Degree of Protection	Second Number	Degree of Protection
0	No special protection	0	No special protection
1	Protected against solid foreign bodies ∅ 50 mm and larger	1	Protected against vertically dripping water
2	Protected against solid foreign bodies ∅ 12,5 mm and larger	2	Protected against dripping water when the enclosure is inclined up to 15 °C
3	Protected against solid foreign bodies ∅ 2,5 mm and larger	3	Protected against spray water being sprayed at an angle up to 60 °
4	Protected against solid foreign bodies ∅ 1 mm and larger	4	Protected against splash water from any direction
5	Dust protected	5	Protected against jet water from any direction
6	Dust-tight	6	Protected against powerful water jets from any direction
		7	Protected against water when the enclosure is immersed in water for a specified time
		8	Protected against water when the enclosure is continuously submerged

Regulations and Approvals Outside the EC Jurisdiction

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

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 – 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	NEC 500-7 CEC 18-010
Classification	Division 1 Division 2	Zone 0 Zone 1 Zone 2	Division 1 Division 2	Division 1 Division 2
Group (Groups to NEC 500 .. or CEC J18-050	- 3	- 7	- 3	
	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)	 E (metals) F (coals) G (grain)	Div. 1 and 2 ---
Temperature classes Class I	Div. 1 and 2	Zone 0, 1 and 2	Div. 1 and 2	none
	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	T1 ≤ 450 °C T2 ≤ 300 °C T3 ≤ 200 °C T4 ≤ 135 °C T5 ≤ 100 °C T6 ≤ 85 °C	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	+	+	–
Phosporic 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