BRITISH STANDARD

BS EN
60079-26:2007

Explosive atmospheres —

Part 26: Equipment with equipment protection level (EPL) Ga

The European Standard EN 60079-26:2007 has the status of a British Standard

ICS 29.260.20

BSI
British Standards

National foreword

This British Standard was published by BSI. It is the UK implementation of EN 60079-26:2007. It is identical with IEC 60079-26:2006. It supersedes BS EN 60079-26:2004, which will be withdrawn on 1 October 2009.

The UK participation in its preparation was entrusted to Technical Committee GEL/31, Equipment for explosive atmospheres.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

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English version

Explosive atmospheres
Part 26: Equipment with equipment protection level (EPL) Ga
(IEC 60079-26:2006)

Atmosphères explosives
Partie 26: Matériel d'un niveau
de protection du matériel (EPL) Ga
(CEI 60079-26:2006)

Explosionsfähige Atmosphäre -
Teil 26: Betriebsmittel
mit Geräteschutzniveau (EPL) Ga
(IEC 60079-26:2006)

This European Standard was approved by CENELEC on 2006-10-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 31/630/FDIS, future edition 2 of IEC 60079-26, prepared by IEC TC 31, Equipment for explosive atmospheres, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60079-26 on 2006-10-01.

This European Standard supersedes EN 60079-26:2004.

The significant changes with respect to EN 60079-26:2004 are:

– changes concerning the accessible chargeable surfaces of the equipment;

– requirements of a partition wall combined with an air-gap with natural ventilation;

– introduction of equipment protection levels (EPL) and substitution of the references to zones (see explanation in Annex A);

– change of heading from "Mechanical connection" to "Process connection" together with a clarification of requirement for any release from Zone 0 of explosive gas atmospheres.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2007-10-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2009-10-01

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and covers essential requirements of EC Directive 94/9/EC. See Annex ZZ.

This European Standard covers Category 1G and combined Category 1/2G electrical equipment.

NOTE Other EC Directives may be applicable

To be in line with the requirements given in Directive 94/9/EC the text given in the body of the standard should be interpreted as given in the following table.

Text given in EN 60079-26	Adaptation to Directive 94/9/EC
Part 26: Equipment with equipment protection level (EPL) Ga	**Part 26: Construction, test and marking of Group II Category 1G electrical equipment**
EPL Ga equipment	Category 1G equipment
EPL Gb type of protection	Category 2G type of protection

Instead of the marking requirements given in Clause 6 of this standard, the apparatus shall be marked according to the requirements of the Directive 94/9/EC for equipment Group II, Category 1G.

Apparatus intended for installation in the boundary wall between areas requiring different categories shall have both categories marked on the label separated by a "/" (see examples below). Additionally, the apparatus shall be marked according to the type of protection as defined in Clause 6.

Examples of marking in compliance with Directive 94/9/EC

a) Apparatus which is intended to be completely installed inside the Zone 0 area for example:

 II 1G

b) Associated apparatus, which is installed outside the hazardous area and providing external electrical circuits protected by intrinsic safety “ia” according to EN 60079-11, which can be connected to Category 1 apparatus , for example:

 II (1)G

NOTE No designation of the temperature class is required, as this apparatus is located outside the hazardous area.

c) Equipment which is installed in the boundary wall between areas requiring different categories, both categories are marked on the label separated by a slash for example:

 II 1/2G

Annexes ZA and ZZ have been added by CENELEC.

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Endorsement notice

The text of the International Standard IEC 60079-26:2006 was approved by CENELEC as a European Standard without any modification.

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CONTENTS

EXPLOSIVE ATMOSPHERES –

Part 26: Equipment with equipment protection level (EPL) Ga

1 Scope

This part of IEC 60079 specifies the particular requirements for construction, test and marking for electrical equipment that provides equipment protection level (EPL) Ga. This electrical equipment, within the operational parameters specified by the manufacturer, ensures a very high level of protection that includes rare faults related to the equipment or two faults occurring independently of each other.

NOTE 1 A malfunction may result from a failure of the component parts of the electrical equipment or from anticipated externally applied influences. Two independent malfunctions which may occur more frequently and which, separately, would not create an ignition hazard but which, in combination, could create a potential ignition hazard, should be regarded as occurring together to form a rare fault.

NOTE 2 This electrical equipment is intended for use in zone 0 hazardous areas, in which explosive gas atmospheres caused by mixtures of air and gases, vapours or mists under normal atmospheric conditions are present continuously, for long periods or frequently.

This standard also applies to equipment mounted across a boundary where different protection levels may be required.

EXAMPLE: In the wall of a storage vessel containing zone 0 with an ambient defined as zone 1.

This standard also applies to equipment installed in an area requiring a lower protection level, but electrically connected to equipment with equipment protection level (EPL) Ga (associated apparatus).

This standard supplements the general requirements in IEC 60079-0 and the requirements of the standardized types of protection, in accordance with the IEC 60079 series, to adapt the level of safety provided by those standards in order to provide EPL Ga.

NOTE 3 In designing equipment for operation in explosive gas atmospheres under conditions other than the atmospheric conditions given in IEC 60079-0, this standard may be used as a guide. However, additional testing is recommended related specifically to the intended conditions of use. This is particularly important when the types of protection ‘Flameproof enclosures’ (IEC 60079-1) and ‘Intrinsic safety’ (IEC 60079-11) are applied.

NOTE 4 The classification of hazardous areas in zones is defined in IEC 60079-10.

NOTE 5 There may be other non-electrical sources of ignition (for example ultrasonic, optical or ionizing radiation) that are not addressed by this standard; these should also be taken into consideration (see, for example, EN 1127-1).

NOTE 6 This concept provides equipment protection level (EPL) Ga. For further information, see Annex A.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60079-0:2004, *Electrical apparatus for explosive gas atmospheres – Part 0: General requirements*

IEC 60079-1, *Electrical apparatus for explosive gas atmospheres – Part 1: Flameproof enclosures "d"*

IEC 60079-10, *Electrical apparatus for explosive gas atmospheres – Part 10: Classification of hazardous areas*

IEC 60079-11, *Explosive atmospheres – Part 11: Equipment protection by intrinsic safety "i"*

IEC 60079-18, *Electrical apparatus for explosive gas atmospheres – Part 18: Construction, test and marking of type of protection encapsulation "m" electrical apparatus*

IEC 60695-11-10, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60079-0 apply, together with the following abbreviation.

NOTE Additional definitions applicable to explosive atmospheres can be found in IEC 60050-426.

3.1
EPL
abbreviation of equipment protection level as defined in Annex A

4 Requirements for design and construction

4.1 General

The equipment shall comply with the requirements of 4.2 for the electrical circuits and with the requirements of 4.3 to 4.6 for mechanical and electrostatic ignition hazards.

4.2 Protection measures against ignition hazards of the electrical circuits

4.2.1 General

The equipment shall comply with the requirements of either

a) 4.2.2 or 4.2.3 in the event of two faults occurring independently of each other in a single equipment means of protection; or

b) 4.2.4 or 4.2.5 in the event of a failure of one equipment means of protection, by the provision of a second independent means of protection.

Electrical connections and permanently connected cables of the equipment sited within an area requiring EPL Ga equipment shall comply with the same level of protection required by this standard, for example an Ex “e” cable containing non-Ex ia circuits additionally protected by a flameproof conduit or an Ex “e” cable provided with an earth leakage protection.

NOTE 1 Detailed cable and installation requirements for non-intrinsically safe circuits providing EPL Ga are in consideration in IEC 60079-14.

NOTE 2 Because of ignition hazards which can arise from faults and/or transient circulating currents in the potential equalization system, galvanic isolation in the power and signal connections to the equipment according to 4.2.2, 4.2.3 and 4.2.4 is preferred. Consideration should also be given to minimize the effect of transient fault currents in the potential equalization network by the use of electrical protection equipment such as sensitive earth leakage monitors.

4.2.2 Intrinsic safety as a sole means of protection

Intrinsically safe electrical equipment providing EPL Ga and intrinsically safe electrical circuits of associated apparatus entering an area requiring EPL Ga shall comply with the requirements of IEC 60079-11, intrinsic safety “ia”.

NOTE Intrinsic safety “ib” in accordance with IEC 60079-11 may be considered as one of two independent means of protection according to 4.2.4.

4.2.3 Encapsulation as a sole means of protection

Electrical equipment which is protected by encapsulation providing EPL Ga shall comply with the requirements of IEC 60079-18, encapsulation “ma”.

NOTE Encapsulation “mb” in accordance with IEC 60079-18 may be considered as one of two independent means of protection according to 4.2.4.

4.2.4 Application of two independent types of protection providing EPL Gb

Electrical equipment shall comply with the requirements of two independent types of protection that provide EPL Gb. If one type of protection fails, the other type of protection shall continue to function. The independent types of protection shall not have a common mode of failure, except as specified in this clause.

An example of a common mode failure is if an Ex “d” enclosure with arcing contacts inside it is used inside an Ex “e” enclosure. If the Ex “d” enclosure is compromised, then arcing inside the enclosure will also compromise the Ex “e” enclosure.

NOTE Combined types of protection providing EPL Gb should depend on different physical protection principles. For example the combination of Ex “d” and Ex “q” both depend on the avoidance of flame propagation and may not be useful in combination. In practice, some combinations may not be useful, for example the combination of oil and powder filling.

Where combined types of protection are used, it shall be possible for each type of protection to be tested individually (see 5.1).

Both types of protection shall be assessed using the most arduous fault condition of the other type of protection. When combining intrinsic safety, type of protection “ib”, with other types of protection, the second type of protection shall be assessed, with the most arduous fault condition applied to the intrinsically safe circuit.

When using two types of protection, which rely both on the same parameter (for example, the creepage distance combining Ex “ib” with Ex “e”), the most stringent requirement of both types of protection shall be applied.

If two types of protection are combined which both rely on the enclosure, one of the following shall be met:

a) if two enclosures are used (one totally enclosed within the other), each enclosure shall comply with the requirements of the respective type of protection; or

b) if only one enclosure is used, the enclosure and the cable glands shall meet the impact test requirements of 26.4.2 of IEC 60079-0, using the group I values.

Examples of combinations of two independent types of protection are as follows:

– inductive transmitters (for example proximity switches, electrical position sensors) with intrinsic safety “ib” enclosed by encapsulation “mb”. The connections to intrinsically safe “ib” circuits can be protected by the increased safety “e”;

– a lamp with the bulb designed as increased safety “e”, the lamp circuit with the switch as intrinsic safety “ib”. These components may be incorporated in a flameproof enclosure “d”;

– measuring transducers with intrinsic safety “ib” and a flameproof enclosure “d”;

– equipment with electrical circuits of intrinsic safety “ib”, additionally protected by a powder filling “q”;

– electromagnetic valves with encapsulation “mb”, enclosed by a flameproof enclosure “d”;

– increased safety “e”, with pressurized equipment “px”.

4.2.5 Application of a type of protection providing EPL Gb and a separation element

4.2.5.1 General

Equipment which is mounted through or forming part of the boundary wall to an area requiring EPL Ga and containing electrical circuits which do not comply with protection level Ga shall comply at least with one of the types of protection providing EPL Gb. Additionally, they shall contain a mechanical separation element as part of the equipment to seal off the electrical circuits of the equipment from the area requiring EPL Ga.

If the type of protection fails, the separation element shall

a) prevent flame propagation through the equipment into the area requiring EPL Ga,

b) maintain its safety characteristics,

c) not be heated above the temperature class of the equipment.

Separation elements consist of a partition wall, possibly combined with a flameproof joint or an air gap with natural ventilation.

4.2.5.2 Partition walls

Partition walls shall be constructed of either

a) corrosion-resistant metals, glass or ceramics, which are specified in the manufacturer’s documentation; or

b) other materials as long as the same level of safety can be demonstrated. In this case, X-marking or an advisory marking in accordance with 29.2 of IEC 60079-0 shall be applied and the certificate shall clearly specify the material and its thermal and mechanical properties to enable the user to confirm the suitability for the particular application.

If the wall thickness is less than 1 mm, the equipment shall be marked with an "X" or an advisory marking according to 29.2 of IEC 60079-0 with a special condition for safe use that the material shall not be subject to environmental conditions which might adversely affect the partition wall. If the partition wall is under constant vibrational stress (for example vibrating membranes), the minimum endurance limit at maximum amplitude shall be defined in the documentation.

NOTE 1 A wall thickness less than 1 mm is only permitted in combination with intrinsic safety "ib", or a flameproof joint or natural ventilation, see 4.2.5.3.

NOTE 2 For glass or ceramics, a minimum thickness of 1/10 of the diameter/maximum dimension but not less than 1 mm is recommended.

In addition to the requirements of 4.2.5.1 to 4.2.5.3, metallic partition walls with a thickness ≥ 1 mm may be provided with suitable conductor bushings (see Figure 1). To avoid a critical concentration of explosive gas atmosphere diffusing from the area requiring EPL Ga into the enclosure containing the electrical circuits, the leakage rate through the bushing shall be low compared to the leakage rate from the enclosure into the free atmosphere. This can be achieved, for example, by using a glass or ceramic bushing as shown in Figure 1.

NOTE 3 Using a standard enclosure with an IP67 rating according to IEC 60529, a bushing with a leakage rate equivalent to a helium-leakage rate less than 10^{-2} Pa×l/s (10^{-4} mbar×l/s) at a pressure difference of 10^{5} Pa (1 bar) is sufficient.

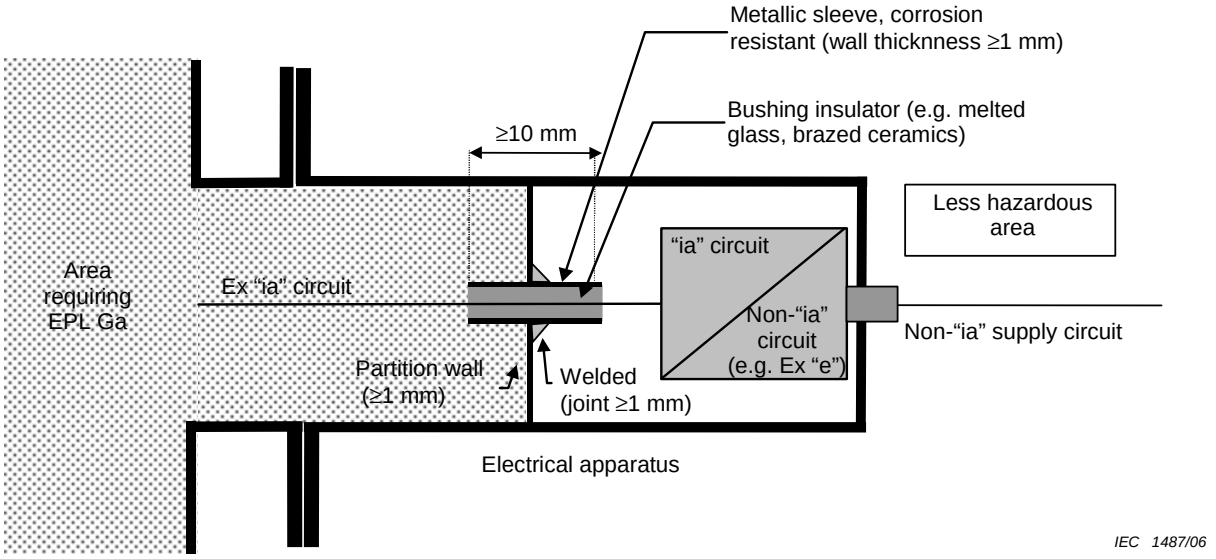


Figure 1 – Example of a partition wall with a conductor bushing being considered gas diffusion tight

4.2.5.3 Requirements depending on the thickness of the partition wall

The combinations of separation elements and additional protective measures depend on the wall thickness, *t*, of the partition wall as described below and shown in Table 1:

i) for homogeneous partition walls with a thickness ≥3 mm, no additional protection measures are required;

ii) for homogeneous partition walls with a thickness of 3 mm > t ≥ 1 mm, one EPL Gb type of protection is required (see example a) of Table 1). A homogeneous part of the enclosure of an equipment with a EPL Gb type of protection may form the partition wall, even for types of protection which rely on the enclosure, provided the equipment does not contain an ignition capable source, for example exposed contacts (see example a) of Table 1). If the equipment contains a source of ignition in normal operation, additionally either a flameproof joint (example b) of Table 1) or a ventilated air gap (example c) of Table 1) is required;

iii) behind partition walls of 1 mm > t ≥ 0,2 mm, one of the following protective measures isrequired:

- type of protection intrinsic safety “ib” according to IEC 60079-11 (example a) of Table 1); or
- one EPL Gb type of protection in combination with a flameproof joint (example b) of Table 1); or
- one EPL Gb type of protection in combination with a ventilated air-gap and a flameproof joint (example c) of Table 1);

iv) for a partition wall with t < 0,2 mm (for example membranes), a flameproof joint and one EPL Gb type of protection are required (example b) of Table 1). If the equipment contains a source of ignition in normal operation (for example by exposed contacts), additionally a ventilated air gap is required (example c) of Table 1).

NOTE In the context of this clause, ‘homogeneous’ means a membrane constructed of a single piece of material without any insertions such as feed-thrus, bushings.

Table 1 – Separation elements

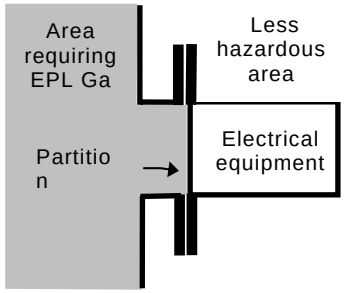
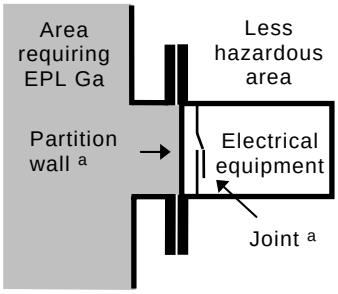
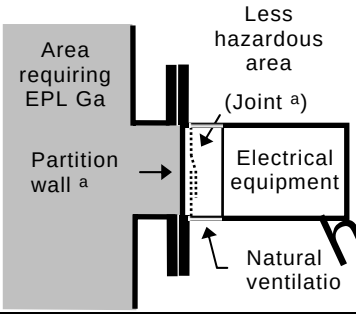
Type of construction	**Requirements depending on the thickness, t, of the partition wall** **i) t ≥ 3 mm: no additional requirements**		
	ii) **3 mm > t ≥ 1mm**	**iii)** **1 mm > t ≥ 0,2 mm (“X” marking required)**	**iv)** **t < 0,2 mm (“X” marking required)**
a) partition wall 	EPL Gb type of protection and no ignition source under normal operation (for example no exposed contacts)	Type of protection intrinsic safety‘ “ib”	Not permissible
b) Partition wall + joint 	EPL Gb type of protection		EPL Gb type of protection and no ignition source under normal operation (for example no exposed contacts)

Table 1 *(continued)*

Type of construction	Requirements depending on the thickness, t, of the partition wall i) $t \geq 3$ mm: no additional requirements		
	ii) 3 mm > $t \geq$ 1mm	iii) 1 mm > $t \geq$ 0,2 mm ("X" marking required)	iv) < 0,2 mm ("X" marking required)
c) Partition wall + ventilation  	EPL Gb type of protection	EPL Gb type of protection and flameproof joint (dashed)	

a Flameproof joint and partition wall are exchangeable in sequence of order.

4.2.5.4 Partition wall combined with a flameproof joint

Joints supplementing partition walls shall comply with either

a) the requirements in IEC 60079-1; or

NOTE 1 To determine the joint characteristics, the free volume of the enclosure containing the electrical circuits should be considered.

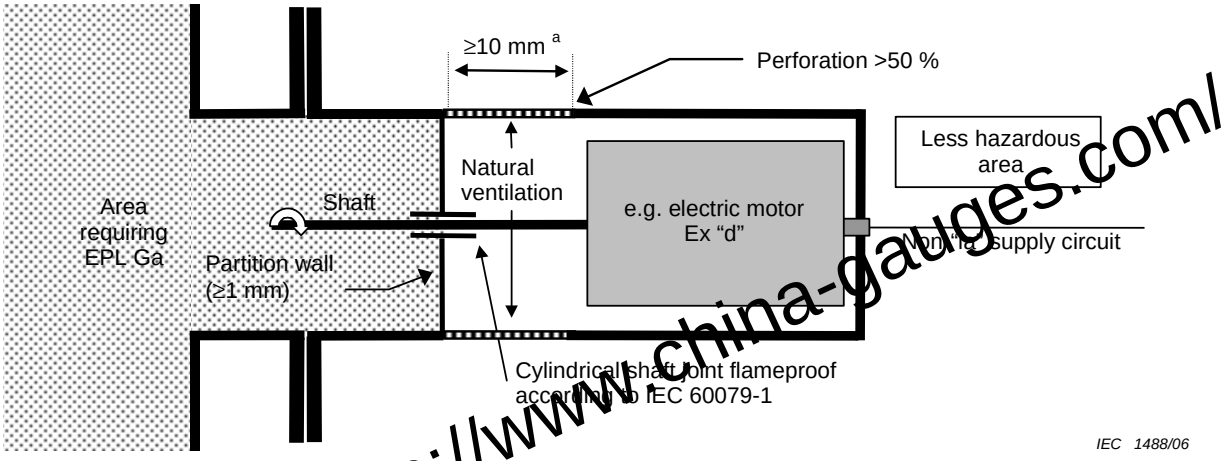
b) a construction, where the same level of safety as for a) can be demonstrated.

NOTE 2 For example, a cylindrical PTFE-bushing pressed form-fit into a metallic enclosure at a length ≥40 mm. A permanently compressed joint with a length of at least 17 mm is also suitable (for example using a conical PTFE-bushing compressed by a spring).

Non-metallic components in separation elements shall meet the requirements of IEC 60695-11-10, flammability category V-0 and have a chemical resistivity equivalent, for example to that of glass, ceramics, non-regenerated PTFE or epoxy resin for petrol applications. The materials of the separation element and its mechanical and thermal stress limits shall be clearly defined in the documentation to enable the user to confirm their suitability for the particular application.

4.2.5.5 Partition wall combined with an airgap with natural ventilation

The ventilation shall ensure that under the most onerous process conditions specified by the manufacturer and the anticipated leakages, an accumulation of flammable materials in the equipment is prevented. Under atmospheric process conditions, the ventilation is valid for all gases, vapours and mists, if the length of the air-gap is ≥10 mm and the effective perforation in the circumference is at least 50 %. In addition to the requirements of 4.2.5.1 to 4.2.5.3, metallic partition walls with a thickness ≥1 mm and a suitable air-gap may be provided, for example with a cylindrical flameproof shaft joint according to IEC 60079-1, see Figure 2. In this case, the ventilation air gap shall have a minimum length of 10 mm or a length equal to the diameter of the shaft, whichever is greater.



[a] Required for sufficient ventilation.

NOTE 1 The cylindrical shaft joint inside the partition wall as shown in Figure 2 is not a supplementing joint as referred to in 4.2.5.4.

NOTE 2 The electrical equipment should be selected in accordance with the appropriate gas group.

Figure 2 – Example of a separation element with a cylindrical shaft joint and natural ventilation

4.3 Equipment with moving parts

4.3.1 Frictional heating

If the equipment contains moving parts, temperature rise due to frictional heating may occur under normal operation or fault condition. It shall be taken into consideration when determining the maximum surface temperature.

4.3.2 Damage arising from failure of moving parts

In case of a failure of moving parts, the types of protection shall not be adversely affected.

4.3.3 Light metals

Operational friction or impact between equipment parts made of light metals or their alloys (with concentrations above the limits given in IEC 60079-0) with equipment parts made of iron/steel is not permitted. Operational friction or impact between two light metals is permitted.

NOTE Light metals are for example aluminium, magnesium, titanium or zirconium.

4.4 Isolated conductive components

Isolated conductive components on the surface of the equipment shall be bonded to ground, except where they cannot be charged to an ignition capable level as demonstrated by the charging test procedure of IEC 60079-0.

4.5 Non-conductive enclosures and accessible non-conductive components

4.5.1 General

Precautions shall be taken to ensure that the risk of ignition from electrostatic discharges is reduced to a negligible level, particularly since equipment providing EPL Ga may be applied directly in the process and non-conductive surfaces may be charged by the flow of non-conductive media (for example in stirring vessels or pipes).

Therefore, the accessible chargeable surfaces of the equipment shall comply with the requirements of 7.3 of IEC 60079-0 or one of the following:

a) limitation of the size of chargeable non-conductive surfaces – see 4.5.2;

b) limitation of the thickness of chargeable non-conductive layers – see 4.5.3;

c) provision of a conductive coating – see 4.5.4.

If none of these requirements can be complied with, X-marking or an advisory marking in accordance with 29.2 of IEC 60079-0 shall be applied and the certificate shall contain special conditions for safe use to enable the user to decide on the suitability of the equipment for the particular application.

4.5.2 Limitation of the size of chargeable non-conductive surfaces

The projection of the chargeable non-conductive surface shall be limited to the values given in in Table 4 of IEC 60079-0 for zone 0 (EPL Ga). In the case of long parts with non-conductive surfaces, such as tubes, bars, cables or ropes, independent of their length, the diameters or widths shall not exceed

a) 3 mm for equipment of groups IIA and IIB;

b) 1 mm for equipment of group IIC.

4.5.3 Limitation of the thickness of chargeable non-conductive layers

Where a non-conductive layer covers a bonded conductive surface, the thickness of that layer shall not exceed

a) 2 mm for equipment of group IIA, IIB;

b) 0,2 mm for equipment of group IIC.

The bonded conductive surface may be formed by a wire mesh with a mesh area as defined in IEC 60079-0, Table 4 for zone 0 (EPL Ga).

NOTE 1 Cables with a protective covering over a screen may comply.

NOTE 2 It should, however, be noted that in the presence of a very efficient charge generating mechanism propagating brush discharges could occur.

4.5.4 Provision of a conductive coating

Non-conductive surfaces may be covered with a bonded durable conductive coating. The resistance between coating and the point of bond shall not exceed 1 GΩ.

The resistance shall be measured in accordance with 26.13 of IEC 60079-0 using a 1 cm^2 electrode at the worst case position of the surface and the point of bond.

X-marking or an advisory marking in accordance with 29.2 of IEC 60079-0 shall be applied and the certificate shall advise on the use of the bonding connection (if separately accessible to the user and not an integral part of the equipment) and provide information to enable the user to decide on the durability of the coating material with respect to the environmental conditions (see Clause 7).

NOTE The requirements of 4.5 will be deleted after incorporation in IEC 60079-0.

4.6 Process connection

If the equipment is mounted across the boundary wall between an area requiring EPL Ga and a less hazardous area, the construction shall ensure that either

a) explosive gas atmospheres cannot be released from an area requiring EPL Ga creating an explosive atmosphere in the surrounding area; or

b) that in case of an ignition of an explosive gas atmosphere in the surrounding area there is no flame propagation into the area requiring EPL Ga.

The equipment shall be designed to allow installation in a manner that will result in a sufficiently tight joint (IP67) or flameproof joint (IEC 60079-1) between the less hazardous area and zone 0.

NOTE 1 For example equipment with an integrated separation element according to 4.2.5 or with an IP67 rating according to IEC 60529 between zone 0 and the less hazardous area are suitable.

Process connections shall comply with an international, or equivalent national, standard.

NOTE 2 Examples of process connections which are considered as suitable include:

a) gas-tight standardized industry flange;

b) gas-tight standardized tube fitting;

c) gas-tight standardized thread connection.

NOTE 3 If, for functional purposes, an opening is required in the boundary wall of zone 0 (for example chemical sampling at the open nozzle, rope guide for probes), instructions for the user are required in the documentation referring to the risk of flammable gas release and flame entrance.

5 Type tests

5.1 Standardized types of protection

Equipment in which EPL Gb types of protection are applied shall be submitted to type verifications and tests as specified in the respective standards. If the combination of two zone 1 types of protection according to 4.2.4 are applied, both types of protection shall be tested independently.

5.2 Separation elements

Separation elements in accordance with 4.2.5 shall be tested in such a way that the operational parameters (for example pressure or temperature limits) stated by the manufacturer are verified.

5.3 Temperature evaluation

For the temperature evaluation, two independent faults shall be taken into account.

This applies also to separation elements of any thickness combined with or partly formed by equipment with one EPL Gb type of protection.

6 Marking

6.1 General

The equipment shall be marked with the EPL and according to the type of protection as defined in the applicable standard.

Equipment intended for installation in the boundary wall between an area requiring EPL Ga and a less hazardous area shall have both EPLs marked on the label separated by a “/” and the corresponding symbols for each type of protection separated by a “/”. In the case where the equipment group or temperature class differ for the two types of protection, the complete designation of each rating shall be used and separated by a “/”.

Where more than one type of protection is used in accordance with 4.2.4, the symbols for the types of protection shall be joined with a “+”.

6.2 Examples of marking

a) Equipment which is intended to be completely installed inside the area requiring EPL Ga, for example:

   Ga Ex ia IIC T6

   or

   Ga Ex d+e IIB T4

b) Associated apparatus, which is installed outside the hazardous area and providing external electrical circuits protected by intrinsic safety “ia” according to IEC 60079-11, which can be connected to equipment providing EPL Ga, for example:

   (Ga) [Ex ia] IIC

   NOTE 1 No designation of the temperature class is required, as this equipment is located outside the hazardous area.

c) Equipment which is installed in the boundary wall between an area requiring EPL Ga and the less hazardous area, both EPLs are marked on the label separated by a slash, for example:

   Ga/Gb Ex d IIC T6

   or

   Ga/Gb Ex ia/d IIC T6

   NOTE 2 Intrinsic safety “ia” equipment providing EPL Ga with a flameproof “d” compartment providing EPL Gb.

   or

   Ga/Gb Ex d+e / d IIB T4

   NOTE 3 Two independent types of protection flameproof “d” and increased safety “e” providing EPL Ga with a flameproof “d” compartment providing EPL Gb.

The documentation shall state which parts of the equipment are suitable for installation in each zone.

7 Information for use

All equipment shall be accompanied by the manufacturer’s safety instructions containing all necessary information for the correct installation and use of the equipment.

Annex A
(informative)

Introduction of an alternative risk assessment method encompassing “equipment protection levels” for Ex equipment

A.0 Introduction

This annex provides an explanation of the concept of a risk assessment method encompassing equipment protection levels (EPLs). These EPLs are introduced to enable an alternative approach to current methods of selecting Ex equipment.

A.1 Historical background

Historically, it has been acknowledged that not all types of protection provide the same level of assurance against the possibility of an incendive condition occurring. The installation standard, IEC 60079-14, allocates specific types of protection to specific zones, on the statistical basis that the more likely or frequent the occurrence of an explosive atmosphere, the greater the level of security required against the possibility of an ignition source being active.

Hazardous areas (with the normal exception of coal mining) are divided into zones, according to the degree of hazard. The degree of hazard is defined according to the probability of the occurrence of explosive atmospheres. Generally, no account is taken of the potential consequences of an explosion, nor of other factors such as the toxicity of materials. A true risk assessment would consider all factors.

Acceptance of equipment into each zone is historically based on the type protection. In some cases, the type of protection may be divided into different levels of protection which again historically correlate to zones. For example, intrinsic safety is divided into levels of protection ia and ib. The encapsulation “m” standard includes two levels of protection “ma” and “mb”.

In the past, the equipment selection standard has provided a solid link between the type of protection for the equipment and the zone in which the equipment can be used. As noted earlier, nowhere in the IEC system of explosion protection is there any account taken of the potential consequences of an explosion, should it occur.

However, plant operators often make intuitive decisions on extending (or restricting) their zones in order to compensate for this omission. A typical example is the installation of "zone 1 type" navigation equipment in zone 2 areas of offshore oil production platforms, so that the navigation equipment can remain functional even in the presence of a totally unexpected prolonged gas release. In the other direction, it is reasonable for the owner of a remote, well-secured, small pumping station to drive the pump with a "zone 2 type" motor, even in zone 1, if the total amount of gas available to explode is small and the risk to life and property from such an explosion can be discounted.

The situation became more complex with the publication of the first edition of IEC 60079-26 which introduced additional requirements to be applied for equipment intended to be used in zone 0. Prior to this, Ex ia was considered to be the only technique acceptable in zone 0.

It has been recognized that it is beneficial to identify and mark all products according to their inherent ignition risk. This would make equipment selection easier and provide the ability to better apply a risk assessment approach, where appropriate.

A.2 General

A risk assessment approach for the acceptance of Ex equipment has been introduced as an alternative method to the current prescriptive and relatively inflexible approach linking equipment to zones. To facilitate this, a system of equipment protection levels has been introduced to clearly indicate the inherent ignition risk of equipment, no matter what type of protection is used.

The system of designating these equipment protection levels is as follows.

A.2.1 Coal mining (group I)

A.2.1.1 EPL Ma

Equipment for installation in a coalmine, having a "very high" level of protection, which has sufficient security that it is unlikely to become an ignition source, even when left energised in the presence of an outbreak of gas.

NOTE Typically, communications circuits and gas detection equipment will be constructed to meet the Ma requirements – for example an Ex ia telephone circuit.

A.2.1.2 EPL Mb

Equipment for installation in a coal mine, having a "high" level of protection, which has sufficient security that it is unlikely to become a source of ignition in the time span between there being an outbreak of gas and the equipment being de-energised.

NOTE Typically, all the coal winning equipment will be constructed to meet the Mb requirements – for example Ex d motors and switchgear.

A.2.2 Gases (group II)

A.2.2.1 EPL Ga

Equipment for explosive gas atmospheres, having a "very high" level of protection, which is not a source of ignition in normal operation, expected faults or when subject to rare faults.

A.2.2.2 EPL Gb

Equipment for explosive gas atmospheres, having a "high" level of protection, which is not a source of ignition in normal operation or when subject to faults that may be expected, though not necessarily on a regular basis.

NOTE The majority of the standard protection concepts bring equipment within this equipment protection level.

A.2.2.3 EPL Gc

Equipment for explosive gas atmospheres, having an "enhanced" level of protection, which is not a source of ignition in normal operation and which may have some additional protection to ensure that it remains inactive as an ignition source in the case of regular expected occurrences (for example failure of a lamp).

NOTE Typically, this will be Ex n equipment.

A.2.3 Dusts (group III)

A.2.3.1 EPL Da

Equipment for combustible dust atmospheres, having a "very high" level of protection, which is not a source of ignition in normal operation or when subject to rare faults.

A.2.3.2 EPL Db

Equipment for combustible dust atmospheres, having a "high" level of protection, which is not a source of ignition in normal operation or when subject to faults that may be expected, though not necessarily on a regular basis.

A.2.3.3 EPL Dc

Equipment for combustible dust atmospheres, having an "enhanced" level of protection, which is not a source of ignition in normal operation and which may have some additional protection to ensure that it remains inactive as an ignition source in the case of regular expected occurrences.

For the majority of situations, with typical potential consequences from a resultant explosion, it is intended that the following would apply for use of the equipment in zones. (This is not directly applicable for coal mining, as the zone concept does not generally apply.) See Table A.1.

Table A.1 – Traditional relationship of EPLs to zones (no additional risk assessment)

Equipment protection level	Zone
Ga	0
Gb	1
Gc	2
Da	20
Db	21
Dc	22

A.3 Risk of ignition protection afforded

The various levels of protection of equipment must be capable of functioning in conformity with the operational parameters established by the manufacturer to that level of protection. See Table A.2.

Table A.2 – Description of risk of ignition protection provided

Protection afforded	Equipment protection level Group	Performance of protection	Conditions of operation
Very high	Ma Group I	Two independent means of protection or safe even when two faults occur independently of each other	Equipment remains functioning when explosive atmosphere present
Very high	Ga Group II	Two independent means of protection or safe even when two faults occur independently of each other	Equipment remains functioning in zones 0, 1 and 2
Very high	Da Group III	Two independent means of protection or safe even when two faults occur independently of each other	Equipment remains functioning in zones 20, 21 and 22
High	Mb Group I	Suitable for normal operation and severe operating conditions	Equipment de-energised when explosive atmosphere present
High	Gb Group II	Suitable for normal operation and frequently occurring disturbances or equipment where faults are normally taken into account	Equipment remains functioning in zones 1 and 2
High	Db Group III	Suitable for normal operation and frequently occurring disturbances or equipment where faults are normally taken into account	Equipment remains functioning in zones 21 and 22
Enhanced	Gc Group II	Suitable for normal operation	Equipment remains functioning in zone 2
Enhanced	Dc Group III	Suitable for normal operation	Equipment remains functioning in zone 22

A.4 Implementation

The 4th edition of IEC 60079-14 (encompassing the former requirements of IEC 61241-14) will introduce the EPLs to allow a system of “risk assessment" as an alternative method for the selection of equipment. Reference will also be included in the classification standards IEC 60079-10 and IEC 61241-10.

The additional marking and the correlation of the existing types of protection are being introduced into the revisions to the following IEC standards:

- IEC 60079-0 (encompassing the former requirements of IEC 61241-0)
- IEC 60079-1
- IEC 60079-2 (encompassing the former requirements of IEC 61241-4)
- IEC 60079-5

- IEC 60079-6
- IEC 60079-7
- IEC 60079-11 (encompassing the former requirements of IEC 61241-11)
- IEC 60079-15
- IEC 60079-18 (encompassing the former requirements of IEC 61241-18)
- IEC 60079-26
- IEC 60079-28

For the types of protection for explosive gas atmospheres, the EPLs require additional marking. For explosive dust atmospheres, the present system of marking the zones on equipment is being replaced by marking the EPLs.

Bibliography

IEC 60050-426:1990, *International Electrotechnical Vocabulary (IEV) – Chapter 426: Electrical apparatus for explosive atmospheres*

IEC 60079-2, *Explosive atmospheres – Part 2: Pressurized enclosures "p"*

NOTE Harmonized as EN 60079-2:2004 (not modified).

IEC 60079-5, *Electrical apparatus for explosive gas atmospheres – Part 5: Powder filling “q”*

IEC 60079-6, *Electrical apparatus for explosive gas atmospheres – Part 6: Oil immersion “o”*

IEC 60079-7, *Explosive atmospheres – Part 7: Equipment protection by ncreased safety “e”*

NOTE Harmonized as EN 60079-7:2007 (not modified).

IEC 60079-14, *Electrical apparatus for explosive gas atmospheres – Part 14: Electrical installations in hazardous areas (other than mines)*

NOTE Harmonized as EN 60079-14:2003 (not modified).

IEC 60079-15, *Electrical apparatus for explosive gas atmospheres – Part 15: Construction, test and marking of type of protection "n" electrical apparatus*

NOTE Harmonized as EN 60079-15:2005 (not modified).

IEC 60079-26:2004, *Electrical apparatus for explosive gas atmospheres – Part 26: Construction, test and marking of Group II Zone 0 electrical apparatus*

NOTE Harmonized as EN 60079-26:2004 (not modified).

IEC 60079-28, *Explosive atmospheres – Part 28: Protection of equipment and transmission systems using optical radiation*

NOTE Harmonized as EN 60079-28:2007 (not modified).

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

NOTE Harmonized as EN 60529:1991 (not modified).

IEC 61241-0, *Electrical apparatus for use in the presence of combustible dust – Part 0: General requirements*

NOTE Harmonized as EN 61241-0:2006 (modified).

IEC 61241-4, *Electrical apparatus for use in the presence of combustible dust – Part 4: Type of protection "pD"*

NOTE Harmonized as EN 61241-4:2006 (not modified).

IEC 61241-10, *Electrical apparatus for use in the presence of combustible dust – Part 10: Classification of areas where combustible dusts are or may be present*

NOTE Harmonized as EN 61241-10:2004 (not modified).

IEC 61241-11, *Electrical apparatus for use in the presence of combustible dust – Part 11: Protection by intrinsic safety 'iD'*

NOTE Harmonized as EN 61241-11:2006 (not modified).

IEC 61241-18, *Electrical apparatus for use in the presence of combustible dust – Part 18: Protection by encapsulation 'mD'*

NOTE Harmonized as EN 61241-18:2004 (not modified).

EN 1127-1, *Explosive atmospheres – Explosion prevention and protection – Part 1: Basic concepts and methodology*

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60079-0 (mod)	2004	Electrical apparatus for explosive gas atmospheres - Part 0: General requirements	EN 60079-0	2006
IEC 60079-1	- [1)]	Electrical apparatus for explosive gas atmospheres - Part 1: Flameproof enclosures 'd'	EN 60079-1 + corr. April	2004 [2)] 2006
IEC 60079-10	- [1)]	Electrical apparatus for explosive gas atmospheres - Part 10: Classification of hazardous areas	EN 60079-10	2003 [2)]
IEC 60079-11	- [1)]	Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"	EN 60079-11	2006 [2)]
IEC 60079-18	- [1)]	Electrical apparatus for explosive gas atmospheres - Part 18: Construction, test and marking of type of protection encapsulation "m" electrical apparatus	EN 60079-18 + corr. April	2004 [2)] 2006
IEC 60695-11-10	- [1)]	Fire hazard testing - Part 11-10: Test flames - 50 W horizontal and vertical flame test methods	EN 60695-11-10	1999 [2)]

[1)] Undated reference.

[2)] Valid edition at date of issue.

Annex ZZ
(informative)

Coverage of Essential Requirements of EC Directives

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and within its scope the standard covers only the following essential requirements out of those given in Annex II of the EC Directive 94/9/EC:

– ER 1.0.1 to ER 1.0.4, ER 1.0.5 (partly), ER 1.0.6 (partly)

– ER 1.1

– ER 1.2.1 (partly), ER 1.2.3, ER 1.2.5 (partly), ER 1.2.8, ER 1.2.9

– ER 1.3.1 (partly), ER 1.3.2 (partly), ER 1.3.3 (partly), ER 1.3.14 (partly)

– ER 1.4.2 (partly)

– ER 2.1.1.1, ER 2.1.1.2

Compliance with this standard provides one means of conformity with the specified essential requirements of the Directive concerned.

WARNING: Other requirements and other EC Directives may be applicable to the products falling within the scope of this standard.

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