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REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

Explosive atmospheres –
Part 26: Equipment with Equipment Protection Level (EPL) Ga

IEC 60079-26:2014-10 RLV(en)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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EXPLOSIVE ATMOSPHERES –

Part 26: Equipment with Equipment Protection Level (EPL) Ga

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International Standard IEC 60079-26 has been prepared by IEC technical committee 31: Equipment for explosive atmospheres.

This third edition cancels and replaces the second edition published in 2006 and constitutes a technical revision.

This edition includes the following significant changes with respect to the previous edition:

		Type		
Changes	**Clause**	**Minor and editorial changes**	**Extension**	**Major technical changes**
Notes deleted	1	X		
Reference to associated apparatus deleted	1	X		
Additional normative references included	3	X		
Requirements against mechanical and electrostatic ignition hazards deleted (now covered in IEC 60079-0)	4.1	X		
Requirement for separation element detailed regarding external influences	4.1.3.2	X		
Intrinsic safety Ex ia as single type of protection including associated apparatus deleted (now covered by EPL)	4.2.2 (ed.2)	X		
Encapsulation Ex ma as single type of protection deleted (now covered by EPL)	4.2.3 (ed.2)	X		
Conditions a) and b) linked with an “and” , therefore requirement of “flameproof joint” deleted in following clause. Both requirements already covered by separation elements and standardised process connections.	4.3	X		
Process connection requires a sufficiently tight joint: IP66 added alternatively to IP67	4.3		X	
Requirement for isolated conductive components deleted (now covered in IEC 60079-0)	4.4 (ed.2)	X		
Requirements for non-conductive enclosures deleted (now covered in IEC 60079-0)	4.5 (ed.2)	X		
Test of partition walls according to 4.1.3.2 b) is specified in more detail	5.2			C1
Marking example for associated apparatus deleted	6.2 b)	X		
Note 3 with an additional example added	6.2	X		
Specification of material of partition wall required in instructions (also required in 4.1.3.2)	7	X		
Alternative risk assessment method deleted (is now generally introduced)	AnnexA (ed.2)	X		

NOTE The technical changes referred to include the significance of technical changes in the revised IEC Standard, but they do not form an exhaustive list of all modifications from the previous version.

Explanation of the types of changes:

A) Definitions

1) Minor and editorial changes:

- Clarification
- Decrease of technical requirements
- Minor technical change
- Editorial corrections

These are changes which modify requirements in an editorial or a minor technical way. They include changes of the wording to clarify technical requirements without any technical change, or a reduction in level of existing requirement.

2) Extension: Addition of technical options

These are changes which add new or modify existing technical requirements, in a way that new options are given, but without increasing requirements for equipment that was fully compliant with the previous standard.Therefore, these will not have to be considered for products in conformity with the preceding edition.

3) Major technical changes:

- addition of technical requirements
- increase of technical requirements

These are changes to technical requirements (addition, increase of the level or removal) made in a way that a product in conformity with the preceding edition will not always be able to fulfil the requirements given in the later edition. These changes have to be considered for products in conformity with the preceding edition. For these changes additional information is provided in Clause B below.

NOTE These changes represent current technological knowledge. However, these changes should not normally have an influence on equipment already placed on the market.

B) Information about the background of 'Major technical changes'

C1: Introduction of type tests for separation elements according to "4.1.3.2 b)"

The text of this standard is based on the following documents:

FDIS	Report on voting
31/1146/FDIS	31/1155/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60079 series, published under the general title *Explosive atmospheres*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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EXPLOSIVE ATMOSPHERES –

Part 26: Equipment with Equipment Protection Level (EPL) Ga

1 Scope

This part of IEC 60079 specifies ~~the particular~~ alternative requirements for construction, test and marking for electrical equipment that provides Equipment Protection Level (EPL) Ga when single standardised Types of Protection (e.g. Ex “ia” , Ex “ma”, Ex “da”) cannot be applied. This standard also applies to equipment mounted across a boundary where different Equipment Protection Levels may be required.

EXAMPLE: Equipment installed in the wall of a storage vessel containing Zone 0 (requiring EPL Ga) inside an area defined as Zone 1 (requiring EPL Gb).

This electrical equipment, within the operational parameters specified by the manufacturer, ensures a very high Level of Protection that includes rare ~~faults~~ malfunctions related to the equipment or two ~~faults~~ malfunctions occurring independently of each other.

NOTE 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~~ are regarded as occurring together to form a rare ~~fault~~ malfunction.

~~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 and modifies the general requirements of IEC 60079-0. Where a requirement of this standard conflicts with a requirement of IEC 60079-0, the requirement of this standard takes precedence. ~~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 documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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~~, *Explosive atmospheres – Part 0: Equipment – General requirements*

IEC 60079-1, *Explosive atmospheres – Part 1: Equipment protection by 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 60529, *Degrees of protection provided by enclosures (IP Code)*

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 and the following apply.

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~~

3.1
separation element
mechanical element inside the equipment, which separates different parts of the equipment with different EPLs

Note 1 to entry: A separation element consists of a mechanical partition wall, which may be combined with a flameproof joint or a natural ventilation

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.~~

4.1 Protection measures against ignition hazards of the electrical circuits

4.1.1 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~~ 4.1.2 or 4.1.3 in the event of a failure of one equipment means of protection, by the provision of a second independent means of protection.

NOTE 1 Types of Protection according to EPL Ga do not require a second independant means of protection, e.g. Ex "ia" (IEC 60079-11), Ex "ma" (IEC 60079-18), Ex "da" (IEC 60079-1).

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"~~ a cable suitable for EPL Gb containing non-Ex "ia" circuits additionally protected by a flameproof conduit or ~~an Ex "e"~~ a cable suitable for EPL Gb provided with earth leakage protection.

NOTE 2 Detailed cable and installation requirements for ~~non~~ Types of Protection accepted as achieving EPL Ga beyond intrinsically safe circuits ~~providing EPL Ga~~ are under consideration in IEC 60079-14.

NOTE 3 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 4.1.2 and 4.1.3 ~~4.2.2, 4.2.3 and 4.2.4 is preferred. Consideration should also be given to minimize~~ is commonly applied along with minimizing 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.~~

4.1.2 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. Combined types of protection providing EPL Gb shall depend on different physical protection principles.

NOTE 1 An example of a common mode of failure is if an Ex "d" enclosure containing arcing ~~contacts~~ components is ~~used~~ installed inside an Ex "e" enclosure. Should the Ex "d" enclosure be compromised, ~~then arcing inside the enclosure will~~ it would also compromise the Ex "e" enclosure.

NOTE 2 ~~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 (same physical protection principle) and may not be useful in combination. In practice, some combinations may not be useful, for example the combination of oil immersion "o" and powder filling "q".

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. Thermal dissipation shall be considered in case of a fault of one Type of protection.

When using two Types of Protection, which both rely 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 relevant 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~~ luminaire designed as increased safety “e”~~, the lamp circuit with the switch as intrinsic safety “ib”. These components~~ may be ~~incorporated~~ included 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 powder filling “q”;

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

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

4.1.3 Application of a Type of Protection providing EPL Gb and a separation element

4.1.3.1 General

Equipment which is mounted through or forms part of the boundary wall to an area requiring EPL Ga and contains electrical circuits which do not comply with ~~protection level~~ EPL Ga shall comply with at least one of the Types of Protection providing EPL Gb. Additionally, it shall contain a mechanical separation element as part of the equipment to ~~seal off~~ separate 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~~ exceed the maximum surface temperature of the specified temperature class of the equipment (see 5.3).

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

4.1.3.2 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 which can be verified to provide the same level of safety. 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~~ the certificate number shall include the "X" suffix in accordance with the marking requirements of IEC 60079-0.

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~~ the certificate number shall include the "X" suffix in accordance with the marking requirements of IEC 60079-0 and the Specific Conditions of Use listed on the certificate shall indicate 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 (see Clause 7). Due to specified process pressure, loads or temperature, the separation element shall not impair the Type of Protection.

~~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 4.1.3.3).

~~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~~ required.

In addition to the requirements of 4.1.3.1 to 4.1.3.3, 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.

~~NOTE 3~~ For example this could be done 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.~~ This can be achieved, for example, by using a glass or ceramic bushing as shown in Figure 1.

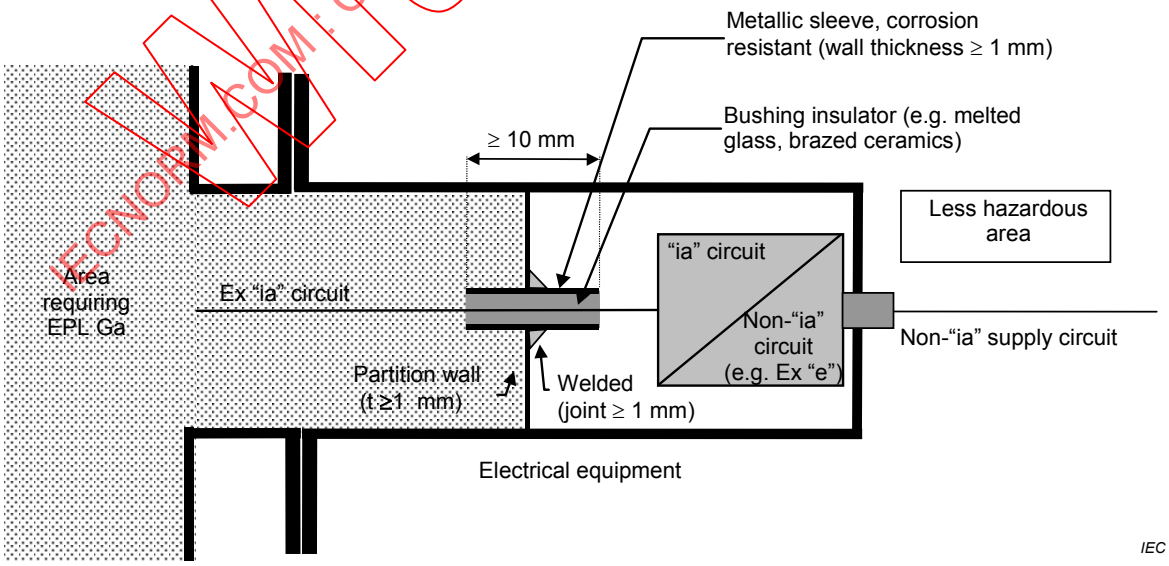


Figure 1 – Example of a partition wall with a conductor bushing considered as gas diffusion tight

4.1.3.3 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, either a flameproof joint (example b) of Table 1) or a ventilated air gap (example c) of Table 1) is also required.

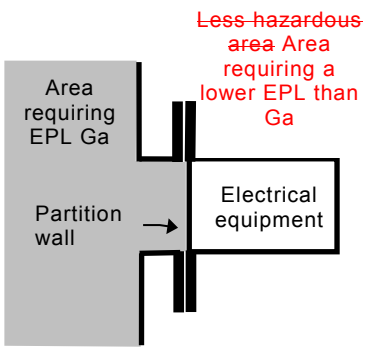
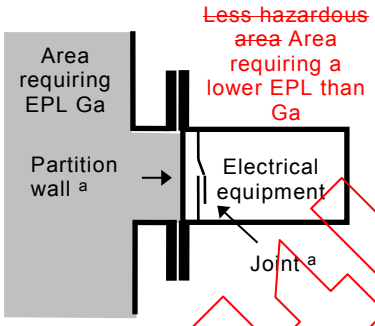
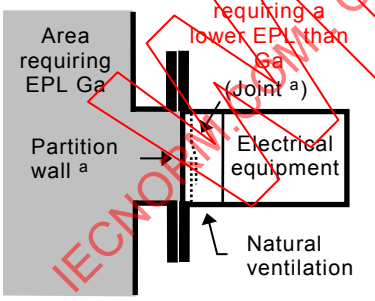
iii) Behind partition walls of 1 mm > t ≥ 0,2 mm, one of the following protective measures is required:

- 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), a ventilated air gap is also required (~~example~~ type 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-throughs, bushings.

Table 1 – Separation elements

<table>
<tr><th rowspan="2">Type of construction</th><th colspan="3">Requirements depending on the thickness, t, of the partition wall
i) t ≥ 3 mm: no additional requirements</th></tr>
<tr><th>ii)
3 mm > t ≥ 1 mm</th><th>iii)
1 mm > t ≥ 0.2 mm
(“X” marking required)</th><th>iv)
t < 0.2 mm
(“X” marking required)</th></tr>
<tr><td>a) Partition wall
  </td><td>EPL Gb Type of Protection
and
no ignition source under normal operation (for example no exposed contacts)</td><td>Type of Protection intrinsic safety “ib”</td><td>Not permissible</td></tr>
<tr><td>b) Partition wall + joint
  </td><td colspan="2">EPL Gb Type of Protection</td><td>EPL Gb Type of Protection
and
no ignition source under normal operation (for example no exposed contacts)</td></tr>
<tr><td>c) Partition wall + ventilation
  </td><td>EPL Gb Type of Protection</td><td colspan="2">EPL Gb Type of Protection
and
flameproof joint (dashed)</td></tr>
<tr><td colspan="4">[a] Flameproof joint and partition wall are exchangeable in sequence of order.</td></tr>
</table>

4.1.3.4 Partition wall combined with a flameproof joint

Joints supplementing partition walls shall comply with either:

a) the requirements in IEC 60079-1;

~~NOTE 1~~ to determine the joint characteristics, the free volume of the enclosure containing the electrical circuits ~~should~~ shall be considered; or

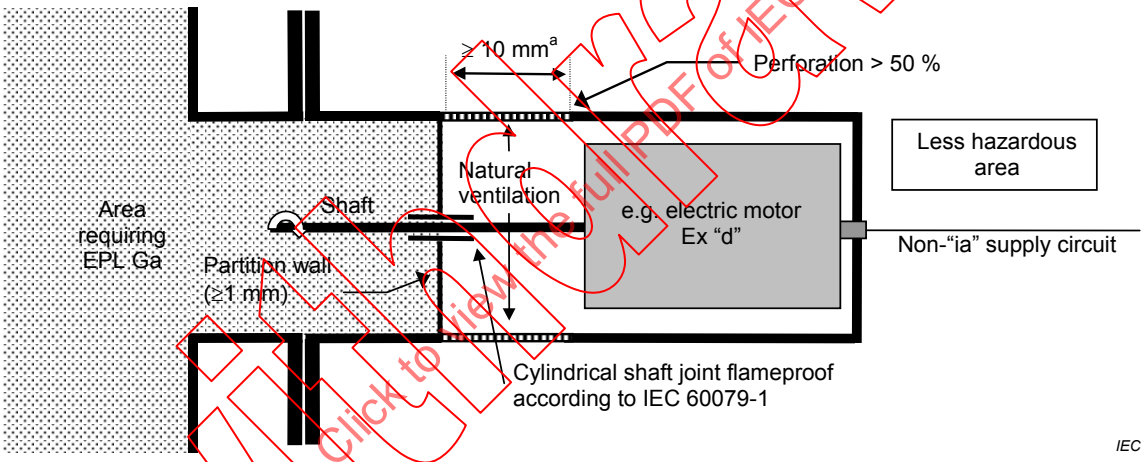
b) a construction, where the same level of safety as for a) can be demonstrated.

NOTE 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~~ petrochemical 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.~~

4.1.3.5 Partition wall combined with an airgap with natural ventilation

The ventilation shall ensure that under the most ~~onerous~~ arduous 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~~ sufficient 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 4.1.3.1 to 4.1.3.3, 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 The cylindrical shaft joint inside the partition wall as shown in Figure 2 is not a supplementing joint as referred to in 4.1.3.4.

~~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

4.2 Equipment with moving parts

4.2.1 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.

4.2.2 Damage arising from failure of moving parts

In case of a failure of moving parts, the Types of Protection shall not be adversely affected.

4.2.3 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 include 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 discharge 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.~~

4.3 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~~ under normal operation conditions:

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

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 (IP 66 or IP 67) or a flameproof joint according to IEC 60079-1 (joints specified for a volume ≤ 100 cm^3) between the less hazardous area and ~~zone 0~~ area requiring EPL Ga.

NOTE 1 For example, equipment with an integrated separation element according to 4.1.3 or with an IP67 rating according to IEC 60529 between ~~zone 0~~ the area requiring EPL Ga and the less hazardous area is 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~~ the area requiring EPL Ga (for example chemical sampling at the open nozzle, rope guide for probes), instructions for the user are required ~~in the documentation referring to~~ to indicate the risk of flammable gas release and flame entrance (see Clause 7).

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~~ EPL Gb Types of Protection according to 4.1.2 are applied, both Types of Protection shall be tested independently.

5.2 Separation elements

Separation elements in accordance with 4.1.3 shall be tested in such a way that the operational parameters (for example pressure or temperature limits) stated by the manufacturer are verified.

Partition walls according to “4.1.3.2b)”

– which are exposed to operational pressure shall be subject to the thermal endurance test of IEC 60079-0 followed by the pressure test. The pressure test shall be performed at maximum operational pressure for 1 min without leakage;

– which are exposed to constant vibrational stress the specified vibrational endurance limit (cycles) shall be verified at the maximum amplitude and at the specified temperature limits.

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 slash “/” ~~and the corresponding symbols for each type of protection separated by a “/”~~. If 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 ~~“/”~~ space.

Where more than one Type of Protection is used in accordance with 4.1.2, the symbols for the Types of Protection shall be joined with a “+”.

6.2 Examples of marking

a) Equipment protected by two Types of Protection which is intended to be completely installed inside the area requiring EPL Ga for example:

~~Ex ia IIC T6 Ga~~
~~or~~
Ex d+e IIB T4 Ga

~~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:~~

~~[Ex ia Ga] IIC~~

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

b) 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:

Ex d IIC T6 Ga/Gb

or

Ex ia/d IIC T6 Ga/Gb

NOTE 1 Intrinsic safety “ia” equipment providing EPL Ga with a flameproof “d” compartment providing EPL Gb.

or

Ex d+e / d IIB T4 Ga/Gb

NOTE 2 Two independent Types of Protection flameproof “d” and increased safety “e” providing EPL Ga with a flameproof “d” compartment providing EPL Gb.

or

Ex ia IIC T4 / Ex d IIB T6 Ga/Gb

NOTE 3 An intrinsically safe sensor providing EPL Ga suitable for Group IIC and having a temperature class T4 and a flameproof compartment providing EPL Gb suitable for Group IIB, having a temperature class T6.

~~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.~~

7 Instructions

7.1 Separation elements:

For equipment according to 4.1.3 the instructions according to IEC 60079-0 shall additionally specify the following details, to enable the user to confirm its suitability for the particular application:

– the material of the partition wall;

– if the wall thickness is less than 1 mm, the instructions shall indicate 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;

– for partition walls according to 4.1.3.2 b): the material and its mechanical and thermal properties;

– for separation elements according to 4.1.3.4: the material of non metallic components in the separation element and its mechanical and thermal stress limits ;

– for separation elements according to 4.1.3.5 to avoid obstruction of the natural ventilation e.g. by presence of dust.

7.2 Process connection:

If an opening is required in the boundary wall of the area requiring EPL Ga the risk of flammable gas release and flame entrance shall be specified.

7.3 EPL allocation

If the marking indicates several EPLs for the equipment (e.g. Ga/Gb), it shall be specified which parts of the equipment comply with the different EPLs.

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	Two independent means of protection or safe even	Equipment remains functioning in zones 0, 1

Protection afforded	Equipment protection level Group Group II	Performance of protection when two faults occur independently of each other	Conditions of operation 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 – Part 426: Equipment for explosive atmospheres*

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

~~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 increased safety "e"*

IEC 60079-14, *Explosive atmospheres – Part 14: Electrical installations design, selection and erection*

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

IEC 60079-18, *Explosive atmospheres – Part 18: Equipment protection by encapsulation "m"*

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

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

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

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

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

~~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*~~

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

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

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

IEC 60079-26

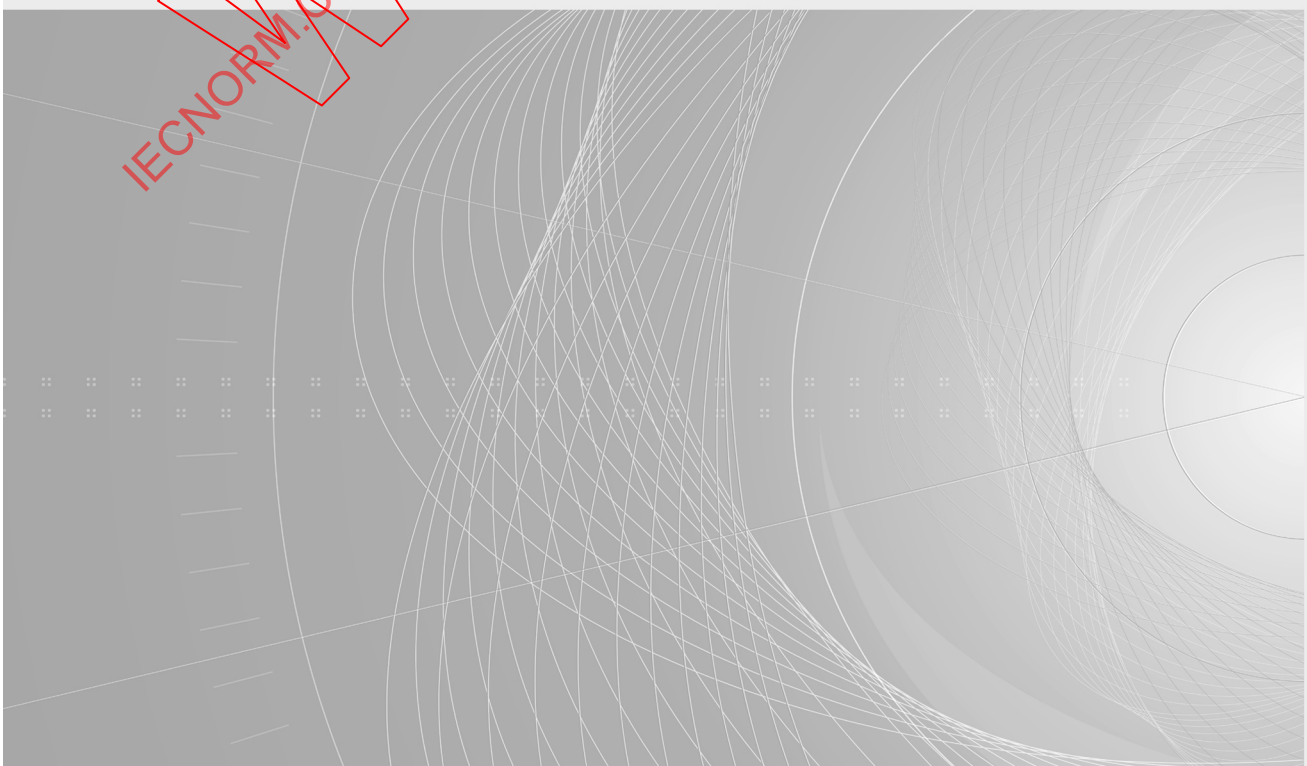
Edition 3.0 2014-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Explosive atmospheres –
Part 26: Equipment with Equipment Protection Level (EPL) Ga

Atmosphères explosives –
Partie 26: Matériel d'un niveau de protection du matériel (EPL) Ga



IEC 60079-26:2014-10(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

EXPLOSIVE ATMOSPHERES –

Part 26: Equipment with Equipment Protection Level (EPL) Ga

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 60079-26 has been prepared by IEC technical committee 31: Equipment for explosive atmospheres.

This third edition cancels and replaces the second edition published in 2006 and constitutes a technical revision.

This edition includes the following significant changes with respect to the previous edition:

		Type		
Changes	**Clause**	**Minor and editorial changes**	**Extension**	**Major technical changes**
Notes deleted	1	X		
Reference to associated apparatus deleted	1	X		
Additional normative references included	3	X		
Requirements against mechanical and electrostatic ignition hazards deleted (now covered in IEC 60079-0)	4.1	X		
Requirement for separation element detailed regarding external influences	4.1.3.2	X		
Intrinsic safety Ex ia as single type of protection including associated apparatus deleted (now covered by EPL)	4.2.2 (ed.2)	X		
Encapsulation Ex ma as single type of protection deleted (now covered by EPL)	4.2.3 (ed.2)	X		
Conditions a) and b) linked with an “and” , therefore requirement of “flameproof joint” deleted in following clause. Both requirements already covered by separation elements and standardised process connections.	4.3	X		
Process connection requires a sufficiently tight joint: IP66 added alternatively to IP67	4.3		X	
Requirement for isolated conductive components deleted (now covered in IEC 60079-0)	4.4 (ed.2)	X		
Requirements for non-conductive enclosures deleted (now covered in IEC 60079-0)	4.5 (ed.2)	X		
Test of partition walls according to 4.1.3.2 b) is specified in more detail	5.2			C1
Marking example for associated apparatus deleted	6.2 b)	X		
Note 3 with an additional example added	6.2	X		
Specification of material of partition wall required in instructions (also required in 4.1.3.2)	7	X		
Alternative risk assessment method deleted (is now generally introduced)	AnnexA (ed.2)	X		

NOTE The technical changes referred to include the significance of technical changes in the revised IEC Standard, but they do not form an exhaustive list of all modifications from the previous version.

Explanation of the types of changes:

A) Definitions

1) Minor and editorial changes:

- Clarification
- Decrease of technical requirements
- Minor technical change
- Editorial corrections

These are changes which modify requirements in an editorial or a minor technical way. They include changes of the wording to clarify technical requirements without any technical change, or a reduction in level of existing requirement.

2) Extension: Addition of technical options

These are changes which add new or modify existing technical requirements, in a way that new options are given, but without increasing requirements for equipment that was fully compliant with the previous standard.Therefore, these will not have to be considered for products in conformity with the preceding edition.

3) Major technical changes:

- addition of technical requirements
- increase of technical requirements

These are changes to technical requirements (addition, increase of the level or removal) made in a way that a product in conformity with the preceding edition will not always be able to fulfil the requirements given in the later edition. These changes have to be considered for products in conformity with the preceding edition. For these changes additional information is provided in Clause B below.

NOTE These changes represent current technological knowledge. However, these changes should not normally have an influence on equipment already placed on the market.

B) Information about the background of 'Major technical changes'

C1: Introduction of type tests for separation elements according to "4.1.3.2 b)"

The text of this standard is based on the following documents:

FDIS	Report on voting
31/1146/FDIS	31/1155/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60079 series, published under the general title *Explosive atmospheres*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

EXPLOSIVE ATMOSPHERES –

Part 26: Equipment with Equipment Protection Level (EPL) Ga

1 Scope

This part of IEC 60079 specifies alternative requirements for construction, test and marking for electrical equipment that provides Equipment Protection Level (EPL) Ga when single standardised Types of Protection (e.g. Ex “ia” , Ex “ma”, Ex “da”) cannot be applied. This standard also applies to equipment mounted across a boundary where different Equipment Protection Levels may be required.

EXAMPLE: Equipment installed in the wall of a storage vessel containing Zone 0 (requiring EPL Ga) inside an area defined as Zone 1 (requiring EPL Gb).

This electrical equipment, within the operational parameters specified by the manufacturer, ensures a very high Level of Protection that includes rare malfunctions related to the equipment or two malfunctions occurring independently of each other.

NOTE 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, are regarded as occurring together to form a rare malfunction.

This standard supplements and modifies the general requirements of IEC 60079-0. Where a requirement of this standard conflicts with a requirement of IEC 60079-0, the requirement of this standard takes precedence.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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, *Explosive atmospheres – Part 0: Equipment – General requirements*

IEC 60079-1, *Explosive atmospheres – Part 1: Equipment protection by flameproof enclosures "d"*

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

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

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

3 Terms and definitions

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

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

3.1
separation element
mechanical element inside the equipment, which separates different parts of the equipment with different EPLs

Note 1 to entry: A separation element consists of a mechanical partition wall, which may be combined with a flameproof joint or a natural ventilation

4 Requirements for design and construction

4.1 Protection measures against ignition hazards of the electrical circuits

4.1.1 General

The equipment shall comply with the requirements of 4.1.2 or 4.1.3 in the event of a failure of one equipment means of protection, by the provision of a second independent means of protection.

NOTE 1 Types of Protection according to EPL Ga do not require a second independant means of protection, e.g. Ex “ia” (IEC 60079-11), Ex “ma” (IEC 60079-18), Ex “da” (IEC 60079-1).

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 a cable suitable for EPL Gb containing non-Ex “ia” circuits additionally protected by a flameproof conduit or a cable suitable for EPL Gb provided with earth leakage protection.

NOTE 2 Detailed cable and installation requirements for Types of Protection accepted as achieving EPL Ga beyond intrinsically safe circuits are under consideration in IEC 60079-14.

NOTE 3 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 4.1.2 and 4.1.3 is commonly applied along with minimizing the effect of transient fault currents in the potential equalization network by the use of electrical protection equipment such as sensitive earth leakage monitors.

4.1.2 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. Combined types of protection providing EPL Gb shall depend on different physical protection principles.

NOTE 1 An example of a common mode of failure is if an Ex “d” enclosure containing arcing components is installed inside an Ex “e” enclosure. Should the Ex “d” enclosure be compromised, it would also compromise the Ex “e” enclosure.

NOTE 2 The combination of Ex “d” and Ex “q” both depend on the avoidance of flame propagation (same physical protection principle) and may not be useful in combination. In practice, some combinations may not be useful, for example the combination of oil immersion “o” and powder filling “q”.

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. Thermal dissipation shall be considered in case of a fault of one Type of protection.

When using two Types of Protection, which both rely 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 IEC 60079-0, using the Group I values.

Examples of relevant 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 luminaire designed as increased safety “e”may be included 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 powder filling “q”;

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

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

4.1.3 Application of a Type of Protection providing EPL Gb and a separation element

4.1.3.1 General

Equipment which is mounted through or forms part of the boundary wall to an area requiring EPL Ga and contains electrical circuits which do not comply with EPL Ga shall comply with at least one of the Types of Protection providing EPL Gb. Additionally, it shall contain a mechanical separation element as part of the equipment to separate 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 exceed the maximum surface temperature of the specified temperature class of the equipment (see 5.3).

4.1.3.2 Partition walls

Partition walls shall be constructed of either:

a) corrosion-resistant metals, glass or ceramics,

b) other materials which can be verified to provide the same level of safety. In this case, the certificate number shall include the "X" suffix in accordance with the marking requirements of IEC 60079-0.

If the wall thickness is less than 1 mm, the certificate number shall include the "X" suffix in accordance with the marking requirements of IEC 60079-0 and the Specific Conditions of Use

listed on the certificate shall indicate 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 (see Clause 7). Due to specified process pressure, loads or temperature, the separation element shall not impair the Type of Protection.

A wall thickness less than 1 mm is only permitted in combination with intrinsic safety "ib", or a flameproof joint or natural ventilation (see 4.1.3.3). For glass or ceramics, a minimum thickness of 1/10 of the diameter/maximum dimension but not less than 1 mm is required.

In addition to the requirements of 4.1.3.1 to 4.1.3.3, 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. For example this could be done 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). This can be achieved, for example, by using a glass or ceramic bushing as shown in Figure 1.

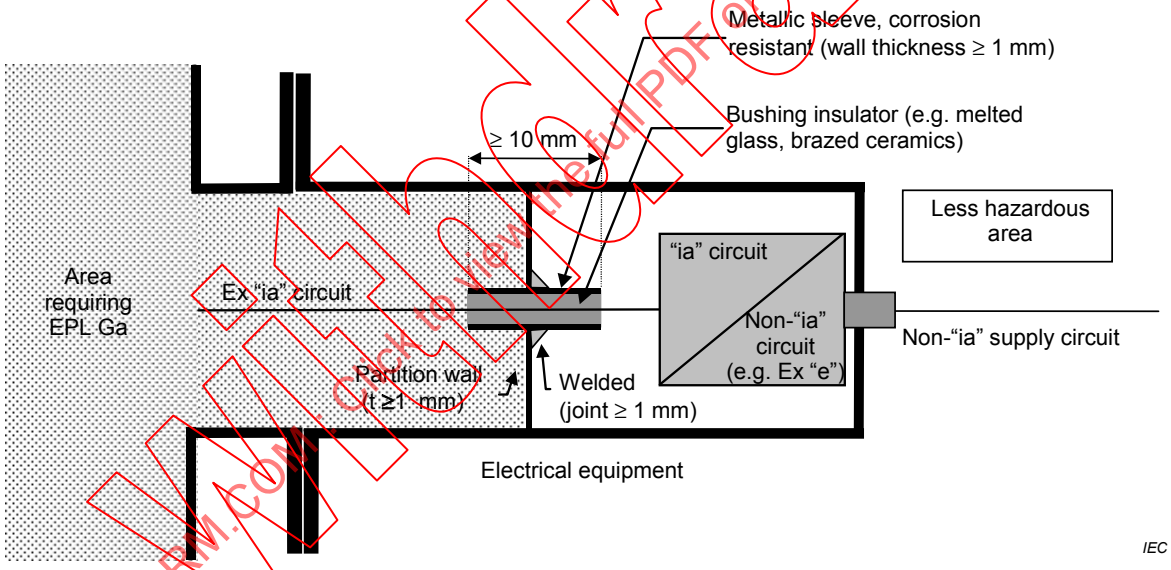


Figure 1 – Example of a partition wall with a conductor bushing considered as gas diffusion tight

4.1.3.3 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, either a flameproof joint (example b) of Table 1) or a ventilated air gap (example c) of Table 1) is also required.

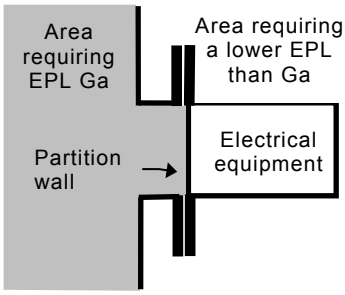
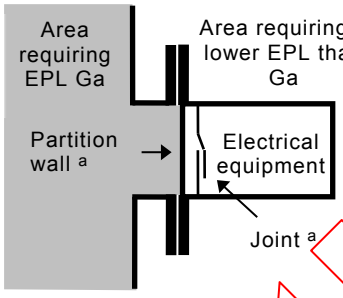
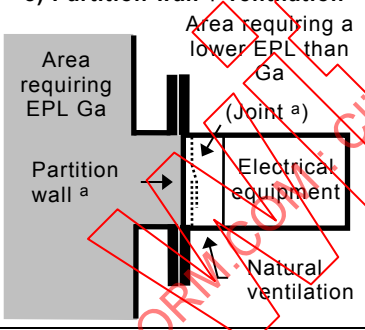
iii) Behind partition walls of 1 mm $> t \geq$ 0,2 mm, one of the following protective measures is required:

- 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), a ventilated air gap is also required (type 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-throughs, bushings.

Table 1 – Separation elements

<table>
<tr><th rowspan="2">Type of construction</th><th colspan="3">Requirements depending on the thickness, t, of the partition wall
i) t ≥ 3 mm: no additional requirements</th></tr>
<tr><th>ii)
3 mm > t ≥ 1 mm</th><th>iii)
1 mm > t ≥ 0.2 mm
(“X” marking required)</th><th>iv)
t < 0.2 mm
(“X” marking required)</th></tr>
<tr><td>a) Partition wall
 
</td><td>EPL Gb Type of Protection
and
no ignition source under normal operation (for example no exposed contacts)</td><td>Type of Protection intrinsic safety’ “ib”</td><td>Not permissible</td></tr>
<tr><td>b) Partition wall + joint
 
</td><td colspan="2">EPL Gb Type of Protection</td><td>EPL Gb Type of Protection
and
no ignition source under normal operation (for example no exposed contacts)</td></tr>
<tr><td>c) Partition wall + ventilation
 
</td><td>EPL Gb Type of Protection</td><td colspan="2">EPL Gb Type of Protection
and
flameproof joint (dashed)</td></tr>
<tr><td colspan="4">a Flameproof joint and partition wall are exchangeable in sequence of order.</td></tr>
</table>

4.1.3.4 Partition wall combined with a flameproof joint

Joints supplementing partition walls shall comply with either:

a) the requirements in IEC 60079-1; to determine the joint characteristics, the free volume of the enclosure containing the electrical circuits shall be considered; or

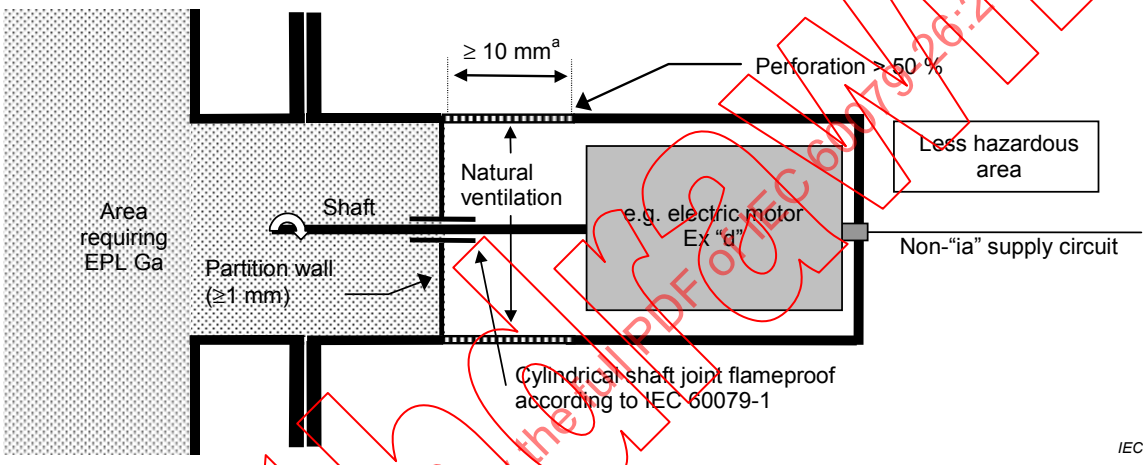
b) a construction, where the same level of safety as for a) can be demonstrated.

NOTE 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 petrochemical applications.

4.1.3.5 Partition wall combined with an airgap with natural ventilation

The ventilation shall ensure that under the most arduous 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 sufficient 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 4.1.3.1 to 4.1.3.3, 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 The cylindrical shaft joint inside the partition wall as shown in Figure 2 is not a supplementing joint as referred to in 4.1.3.4.

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

4.2 Equipment with moving parts

4.2.1 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.

4.2.2 Damage arising from failure of moving parts

In case of a failure of moving parts, the Types of Protection shall not be adversely affected.

4.2.3 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 include for example aluminium, magnesium, titanium or zirconium.

4.3 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 under normal operation conditions:

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

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 (IP 66 or IP 67) or a flameproof joint according to IEC 60079-1 (joints specified for a volume ≤ 100 cm^3) between the less hazardous area and area requiring EPL Ga.

NOTE 1 For example, equipment with an integrated separation element according to 4.1.3 or with an IP67 rating according to IEC 60529 between the area requiring EPL Ga and the less hazardous area is 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.

If, for functional purposes, an opening is required in the boundary wall of the area requiring EPL Ga (for example chemical sampling at the open nozzle, rope guide for probes), instructions for the user are required to indicate the risk of flammable gas release and flame entrance (see Clause 7).

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 EPL Gb Types of Protection according to 4.1.2 are applied, both Types of Protection shall be tested independently.

5.2 Separation elements

Separation elements in accordance with 4.1.3 shall be tested in such a way that the operational parameters (for example pressure or temperature limits) stated by the manufacturer are verified.

Partition walls according to “4.1.3.2b)”

– which are exposed to operational pressure shall be subject to the thermal endurance test of IEC 60079-0 followed by the pressure test. The pressure test shall be performed at maximum operational pressure for 1 min without leakage;

– which are exposed to constant vibrational stress the specified vibrational endurance limit (cycles) shall be verified at the maximum amplitude and at the specified temperature limits.

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 slash "/". If 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 space.

Where more than one Type of Protection is used in accordance with 4.1.2, the symbols for the Types of Protection shall be joined with a "+".

6.2 Examples of marking

a) Equipment protected by two Types of Protection which is intended to be completely installed inside the area requiring EPL Ga for example:

   Ex d+e IIB T4 Ga

b) 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:

   Ex d IIC T6 Ga/Gb

   or

   Ex ia/d IIC T6 Ga/Gb

   NOTE 1 Intrinsic safety "ia" equipment providing EPL Ga with a flameproof "d" compartment providing EPL Gb.

   or

   Ex d+e / d IIB T4 Ga/Gb

   NOTE 2 Two independent Types of Protection flameproof "d" and increased safety "e" providing EPL Ga with a flameproof "d" compartment providing EPL Gb.

   or

   Ex ia IIC T4 / Ex d IIB T6 Ga/Gb

   NOTE 3 An intrinsically safe sensor providing EPL Ga suitable for Group IIC and having a temperature class T4 and a flameproof compartment providing EPL Gb suitable for Group IIB, having a temperature class T6.

7 Instructions

7.1 Separation elements:

For equipment according to 4.1.3 the instructions according to IEC 60079-0 shall additionally specify the following details, to enable the user to confirm its suitability for the particular application:

– the material of the partition wall;

– if the wall thickness is less than 1 mm, the instructions shall indicate 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;

– for partition walls according to 4.1.3.2 b): the material and its mechanical and thermal properties;
– for separation elements according to 4.1.3.4: the material of non metallic components in the separation element and its mechanical and thermal stress limits ;
– for separation elements according to 4.1.3.5 to avoid obstruction of the natural ventilation e.g. by presence of dust.

7.2 Process connection:

If an opening is required in the boundary wall of the area requiring EPL Ga the risk of flammable gas release and flame entrance shall be specified.

7.3 EPL allocation

If the marking indicates several EPLs for the equipment (e.g. Ga/Gb), it shall be specified which parts of the equipment comply with the different EPLs.

Bibliography

IEC 60050-426, *International Electrotechnical Vocabulary – Part 426: Equipment for explosive atmospheres*

IEC 60079-7, *Explosive atmospheres – Part 7: Equipment protection by increased safety "e"*

IEC 60079-14, *Explosive atmospheres – Part 14: Electrical installations design, selection and erection*

IEC 60079-18, *Explosive atmospheres – Part 18: Equipment protection by encapsulation "m"*

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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ATMOSPHÈRES EXPLOSIVES –

Partie 26: Matériel d'un niveau de protection du matériel (EPL) Ga

AVANT-PROPOS

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La Norme internationale IEC 60079-26 a été établie par le comité d'études 31 de l'IEC: Matériels pour atmosphères explosives.

Cette troisième édition annule et remplace la deuxième édition parue en 2006 et constitue une révision technique.

Cette édition inclut les modifications significatives suivantes par rapport à l'édition précédente:

		Type		
Modifications	**Article**	**Modifications mineures et éditoriales**	**Extension**	**Modifications techniques majeures**
Suppressions de notes	1	X		
Suppression de référence aux matériels associés	1	X		
Inclusion de références normatives supplémentaires	3	X		
Suppression des exigences relatives aux dangers d'allumage d'origine mécanique ou électrostatique (à présent couvertes par l'IEC 60079-0)	4,1	X		
Apport de détails pour l'exigence relative à l'élément de séparation concernant les influences externes	4.1.3.2	X		
Suppression de la sécurité intrinsèque Ex ia comme mode unique de protection y compris le matériel associé (désormais couverte par EPL)	4.2.2 (éd.2)	X		
Suppression de l'encapsulation Ex ma comme mode unique de protection (désormais couverte par EPL)	4.2.3 (éd.2)	X		
Conditions a) et b) reliées par un "et", d'où suppression de l'exigence de "joint antidéflagrant " dans l'article suivant. Les deux exigences étant déjà traitées par les éléments de séparation et les connexions intervenant dans les opérations normalisées.	4.3	X		
La connexion intervenant pendant l'opération nécessite un joint suffisamment étanche: Ajout de IP66 en variante à IP67	4.3		X	
Suppression de l'exigence relative aux composants conducteurs isolés (désormais couverte par l'IEC 60079-0)	4.4 (éd.2)	X		
Suppression des exigences relatives aux enveloppes non conductrices (désormais couvertes par l'IEC 60079-0)	4.5 (éd.2)	X		
L'essai des cloisons de séparation selon le 4.1.3.2 b) est davantage précisé	5.2			C1
Suppression des exemples de marquage pour le matériel associé	6.2 b)	X		
Ajout d'une Note 3 comportant un exemple supplémentaire	6.2	X		
Spécification de matériau de cloison de séparation exigée dans les instructions (également exigée en 4.1.3.2)	7	X		
Suppression de la méthode alternative d'évaluation des risques (elle est désormais généralement introduite)	Annexe A (éd.2)	X		

NOTE Les modifications techniques auxquelles il est fait référence comprennent la signification des modifications techniques dans la Norme IEC révisée, mais ne constituent pas une liste exhaustive de toutes les modifications apportées par rapport à la version précédente.

Explication des types de modifications:

A) Définitions

1) Modifications mineures et éditoriales:

- Clarification
- Diminution des exigences techniques
- Modification technique mineure
- Corrections éditoriales

Il s'agit de modifications éditoriales ou de modifications techniques mineures apportées aux exigences. Elles comprennent les modifications de formulations pour clarifier les exigences techniques sans aucune modification technique, ou une réduction du niveau des exigences existantes.

2) Extension: Ajout d'options techniques

Il s'agit de modifications qui ajoutent de nouvelles exigences techniques ou modifient les exigences techniques existantes, de telle manière que de nouvelles options sont données, mais sans augmenter les exigences pour les matériels qui étaient totalement conformes à la norme précédente. Par conséquent, celles-ci ne devront pas être prises en compte pour les produits conformes à l'édition précédente.

3) Modifications techniques majeures:

- ajout d'exigences techniques
- augmentation d'exigences techniques

Il s'agit de modifications apportées aux exigences techniques (ajout, augmentation du niveau ou suppression), de telle manière qu'un produit conforme à l'édition précédente ne pourra pas toujours satisfaire aux exigences données dans la dernière édition. Ces modifications doivent être prises en compte pour les produits conformes à l'édition précédente. Concernant ces modifications, des informations supplémentaires sont données dans l'article B ci-dessous.

NOTE Ces modifications représentent les connaissances technologiques actuelles. Il convient néanmoins que ces modifications n'aient en principe pas d'influence sur les matériels déjà commercialisés.

B) Informations de base concernant les 'modifications techniques majeures'

C1: Introduction d'essais de type relatifs aux éléments de séparation selon le"4.1.3.2 b)"

Le texte de cette norme est issu des documents suivants:

FDIS	Rapport de vote
31/1146/FDIS	31/1155/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette norme.

Cette publication a été rédigée selon les Directives ISO/IEC, Partie 2.

Une liste de toutes les parties de la série IEC 60079, publiées sous le titre général *Atmosphères explosives*, peut être consultée sur le site web de l'IEC.

Le comité a décidé que le contenu de cette publication ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "http://webstore.iec.ch" dans les données relatives à la publication recherchée. A cette date, la publication sera

- reconduite,
- supprimée,
- remplacée par une édition révisée, ou
- amendée.

ATMOSPHÈRES EXPLOSIVES –

Partie 26: Matériel d'un niveau de protection du matériel (EPL) Ga

1 Domaine d'application

La présente partie de l'IEC 60079 spécifie les exigences alternatives relatives à la construction, aux essais et au marquage du matériel électrique fournissant le niveau de protection du matériel (EPL, *Equipment Protection Level*) Ga lorsque des types normalisés uniques de Protection (comme par ex. Ex “ia” , Ex “ma”, Ex “da”) ne peuvent pas être appliqués. La présente norme s’applique au matériel installé en chevauchement sur des emplacements pour lesquels différents niveaux de protection du matériel peuvent être exigés.

EXEMPLE: Matériel installé dans la cloison d'un conteneur de stockage contenant une Zone 0 (exigeant l'EPL Ga) dans un emplacement défini comme étant une Zone 1 (exigeant l'EPL Gb).

Ce matériel électrique assure, dans les limites des paramètres de fonctionnement spécifiés par le constructeur, un très haut niveau de protection prenant en compte le cas de rares dysfonctionnements liés au matériel, ou d’apparition simultanée de deux dysfonctionnements indépendants l’un de l’autre.

NOTE Un dysfonctionnement peut résulter d’une défaillance d’un composant du matériel électrique ou d’une influence externe prévisible. Deux dysfonctionnements indépendants qui peuvent apparaître plus fréquemment et qui, séparément, ne créeraient pas de risque d’allumage, mais qui, ensemble, pourraient créer un risque d’allumage, sont considérés dans leur conjonction comme formant un dysfonctionnement rare.

La présente norme complète et modifie les exigences générales de l'IEC 60079-0. Lorsqu'une exigence de la présente norme entre en contradiction avec une exigence de l'IEC 60079-0, l’exigence de la présente norme prévaut.

2 Références normatives

Les documents suivants sont cités en référence de manière normative, en intégralité ou en partie, dans le présent document et sont indispensables pour son application. Pour les références datées, seule l’édition citée s’applique. Pour les références non datées, la dernière édition du document de référence s’applique (y compris les éventuels amendements).

IEC 60079-0, *Atmosphères explosives – Partie 0: Matériel – Exigences générales*

IEC 60079-1, *Atmosphères explosives – Partie 1: Protection du matériel par enveloppes antidéflagrantes "d"*

IEC 60079-11, *Atmosphères explosives – Partie 11: Protection de l'équipement par sécurité intrinsèque "i"*

IEC 60695-11-10, *Essais relatifs aux risques du feu – Partie 11-10: Flammes d'essai – Méthodes d'essai horizontal et vertical à la flamme de 50 W*

IEC 60529, *Degrés de protection procurés par les enveloppes (Code IP)*