IEC 60079-26

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Explosive atmospheres –
Part 26: Equipment with Separation Elements or combined Levels of Protection

Atmosphères explosives –
Partie 26: Appareil avec éléments de séparation ou niveaux de protection combinés

IEC 60079-26:2021-02(en-fr)

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IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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CONTENTS

FOREWORD 4
1 Scope 7
2 Normative references 7
3 Terms and definitions 8
4 Ex Equipment with two combined Types of Protection 8
4.1 General 8
4.2 Basic requirements 8
4.3 Electrical Connections 9
5 Ex Equipment containing parts with different EPLs and a separation element 9
5.1 General 9
5.2 Separation elements 9
5.2.1 General 9
5.2.2 Basic requirements 10
5.2.3 Mechanical partition walls 10
5.2.4 Metallic partition walls with gas-tight conductor bushings 10
5.2.5 Partition wall supplemented with a joint 11
5.2.6 Partition wall for explosive gas atmospheres supplemented with natural ventilation 11
5.2.7 Requirements depending on the thickness of the partition wall 12
6 Process connection 13
7 Type tests 14
7.1 Standardized Types of Protection 14
7.2 Separation elements 14
7.3 Temperature evaluation 14
8 Marking 14
8.1 General 14
8.2 Ex Equipment with two combined Types of Protection 14
8.3 Ex Equipment containing parts with different EPLs 15
8.4 Examples of marking: 15
9 Instructions 16
9.1 Separation elements 16
9.2 Process connection 16
9.3 EPL allocation 16
Annex A (normative) Types of construction for separation elements 17
Bibliography 23

Figure 1 – Partition wall with a conductor bushing considered as gas diffusion tight 11
Figure 2 – Example of a separation element with a cylindrical shaft joint and ventilation 12
Figure 3 – Example g) of marking of equipment with a separation element 15

Table 1 – Requirements for Ex Equipment containing parts with different EPLs. 9
Table A.1 – Ex Equipment with separation elements mounted at a boundary of Zone 0 17
Table A.2 – Ex Equipment with separation elements mounted at a boundary of Zone 1 18
Table A.3 – Ex Equipment with separation elements mounted at a boundary of Zone 20 19
Table A.4 – Ex Equipment with separation elements mounted at a boundary of Zone 21 19

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Table A.5 – Ex Equipment with separation elements mounted at a boundary of Zone 0 in Zone 21 or 22 20
Table A.6 – Ex Equipment with separation elements mounted at a boundary of Zone 1 in Zone 21 or 22 20
Table A.7 – Ex Equipment with separation elements mounted at a boundary of Zone 20 in Zone 1 or 2 21
Table A.8 – Ex Equipment with separation elements mounted at a boundary of Zone 21 in Zone 1 or 2 22

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EXPLOSIVE ATMOSPHERES –

Part 26: Equipment with Separation Elements or combined Levels of Protection

FOREWORD

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

This fourth edition cancels and replaces the third edition published in 2014 and constitutes a technical revision.

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

Changes	Clause	Type		
		Minor and editorial changes	Extension	Major technical changes
The scope of the standard was extended for separation elements between all EPLs for gas and dust hazardous areas as well as for non-electrical equipment. The title and the structure of the standard was modified accordingly.	5		x	
The requirements for combined Types of Protection 4.1.2 were restructured and included in Clause 4	4	x		
The requirements for equipment with moving parts was removed and transferred to IEC 60079-0	4.2 (ed. 3)	x		
For equipment with partition walls other than corrosion resistant metals, glass or ceramic the type tests were detailed and the cycling test acc. to IEC TS 60079-40 specified, if they were exposed to constant vibrational stress	7.2			C1
The marking is extended for equipment to be mounted between different Zones	8		x	
The thickness of the partition wall must be specified in the instructions	9	x		
Additional warnings are included in the instructions for equipment with separation elements exposed to abrasive dust flow	9		x	
Table 1 "Separation elements" was moved to Annex A as Table A.1 and modified for clarification	Table A.1	x		
Table A.2 to table A.8 added for the extended separation elements			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.

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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 to ensure that partition walls consisting of materials other than stainless steel, ceramics or glass, which are exposed to pressure or vibrational stress, provide a comparable level of safety, additional endurance tests were included. Reference to tests in IEC TS 60079-40 were considered appropriate.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
31/1562/FDIS	31/1564/RVD

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

This document 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 document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
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EXPLOSIVE ATMOSPHERES –

Part 26: Equipment with Separation Elements or combined Levels of Protection

1 Scope

This part of IEC 60079 specifies requirements for construction, testing and marking for Ex Equipment that contains parts of the equipment with different Equipment Protection Levels (EPLs) and a separation element. This equipment is mounted across a boundary where different EPLs are required, for example between different gas hazardous areas, dust hazardous areas or gas hazardous areas adjacent to dust hazardous areas.

EXAMPLE: Equipment installed in the wall of storage tanks located in Zone 1 and containing Zone 0 inside.

Separation elements are considered for both electrical and non-electrical equipment. If mechanical energy can be transformed into a potential ignition source, additionally an ignition hazard assessment in accordance with ISO 80079-36 is performed and appropriate measures are undertaken. Suitable measures can be selected from ISO 80079-37 or IEC TS 60079-42.

This document also specifies requirements for the combination of two Types of Protection, each with EPL Gb, to achieve EPL Ga. Examples are included in 4.2.

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

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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, *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 60079-31, *Explosive atmospheres – Part 31: Equipment dust ignition protection by enclosure "t"*

IEC TS 60079-40, *Explosive atmospheres – Part 40: Requirements for process sealing between flammable process fluids and electrical systems*

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*

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ISO 80079-36, *Explosive atmospheres – Part 36: Non-electrical equipment for explosive atmospheres – Basic method and requirements*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 Ex Equipment with two combined Types of Protection

4.1 General

To achieve EPL Ga, electrical equipment may comply with the requirements of two independent Types of Protection each of EPL Gb. If one Type of Protection fails, the other Type of Protection shall continue to function. Then even during rare malfunctions, for example two independent faults, no ignition source can occur.

4.2 Basic requirements

The independent Types of Protection shall not have a common mode of failure, except as specified below (see a) and b)). Combined Types of Protection of EPL Gb shall depend on different physical protection principles.

NOTE 1 An example for an unacceptable common mode of failure is an Ex "db" enclosure containing arcing components installed inside an Ex "eb" enclosure. Should the Ex "db" enclosure be compromised, it would also compromise the Ex "eb" enclosure.

NOTE 2 The combination of Ex "db" and Ex "q" both depend on the avoidance of flame propagation (same physical protection principle) and are not suitable in combination. In practice, some combinations are not suitable, for example the combination of liquid immersion "ob" and powder filling "q".

Both Types of Protection shall be assessed using the most onerous malfunction condition of the other Type of Protection. When combining intrinsic safety, i.e. Level of Protection "ib", with another Type of Protection, the second Type of Protection shall be assessed after the application of faults to the intrinsically safe apparatus which result in the most onerous condition as specified in IEC 60079-11. 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 when combining Ex "ib" with Ex "eb"), 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";

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NOTE The connections to intrinsically safe "ib" circuits can be protected by increased safety "eb";

– a luminaire designed as increased safety "eb" included in a flameproof enclosure "db";
– measuring transducers with intrinsic safety "ib" enclosed by a flameproof enclosure "db";
– equipment with electrical circuits of intrinsic safety "ib", additionally protected by powder filling "q";
– electromagnetic valves with encapsulation "mb", enclosed by a flameproof enclosure "db";
– increased safety "eb", with pressurized equipment "pxb".

4.3 Electrical Connections

Electrical connections and permanently connected cables of the equipment sited within an area requiring EPL Ga shall comply with EPL Ga.

NOTE Installation requirements for equipment with EPL Ga achieved by combined types of protection are in IEC 60079-14, Edition 6[1].

5 Ex Equipment containing parts with different EPLs and a separation element

5.1 General

Equipment which is mounted through or forms part of the boundary wall between different Zones may contain different parts which comply with different EPLs. In this case the equipment shall contain a separation element between the different parts of the equipment (see Table 1).

Table 1 – Requirements for Ex Equipment containing parts with different EPLs.

		Part complying with			
		EPL Ga	**EPL Gb**	**EPL Da**	**EPL Db**
Part complying with	**EPL Gb**	Table A.1	-	Table A.7	Table A.8
	EPL Gc	Table A.1	Table A.2	Table A.7	Table A.8
	EPL Db	Table A.5	Table A.6	Table A.3	-
	EPL Dc	Table A.5	Table A.6	Table A.3	Table A.4

NOTE Boundaries are not considered for hybrid mixtures.

Equipment which fully complies with one EPL, which is suitable for both of the Zones on either side of the boundary does not require a separation element complying with the requirements of this document.

5.2 Separation elements

5.2.1 General

A separation element consists of a mechanical partition wall, which may be supplemented with a flameproof joint, a dust-tight joint, a natural ventilation or a combination of these, as applicable and detailed in 5.2.2 to 5.2.7 and Annex A.

[1] Under consideration.

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5.2.2 Basic requirements

The following basic requirements apply for separation elements:

a) a separation element shall provide a boundary between different areas or parts of the equipment complying with different EPLs to avoid a migration of flammable gasses, vapours or dusts from parts of the equipment with higher EPL into parts of the equipment with lower EPL;

b) if a potential ignition source becomes active in the part of the equipment with the lower EPL, it shall not act as an ignition source in the part of the equipment with the higher EPL, for example the permissible surface temperature of the separation element shall not be exceeded; and

c) if an ignition can occur in the part of the equipment with the lower EPL, flame propagation into the part with the higher EPL shall be avoided. This consideration is not applicable to EPL Db or Dc enclosures with dust exclusion according to IP 5X.

NOTE EPL Gc is considered lower than EPL Gb or EPL Ga. EPL Gb is considered lower than EPL Ga. The same principle applies to EPLs Da, Db and Dc.

5.2.3 Mechanical partition walls

Partition walls shall be constructed of either:

a) corrosion-resistant metal, glass or ceramic;

b) other materials which can be verified as providing 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, the certificate shall include the Specific Conditions of Use and the material shall be specified in the instructions according to Clause 9.

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 instructions (see Clause 9).

For mechanical loads (for example pressure, static forces, torques) the applicable safety requirements of the relevant industrial standards shall be applied. Due to the maximum allowable specified process pressure, loads or temperature, the separation element shall not impair the Type of Protection.

For glass or ceramic partitions, a minimum thickness of 10 % of the diameter/maximum dimension is required, with a minimum thickness of 1 mm.

A partition wall of other than metal, glass or ceramic shall be subjected to thermal endurance tests according to IEC 60079-0 before the IP testing.

Partition walls used in equipment mounted in the boundary wall of Zone 20 or Zone 21 containments shall be dust-tight according to IP6X for the specified process conditions (for example process pressure). When the surrounding area is classified as either Zone 1 or Zone 2, the partition shall additionally meet the enclosure requirements of IEC 60079-31 to ensure a hybrid mixture is not formed within the equipment. Partition walls separating EPL Da/Gb (Table A.7) shall comply with the type test for enclosures EPL Da. Partition walls separating EPL Db/Gb (Table A.8) shall comply with the type test for enclosures EPL Db.

5.2.4 Metallic partition walls with gas-tight conductor bushings

Metallic partition walls with a thickness ≥ 1 mm may be provided with suitable conductor bushings. (See Figure 1).

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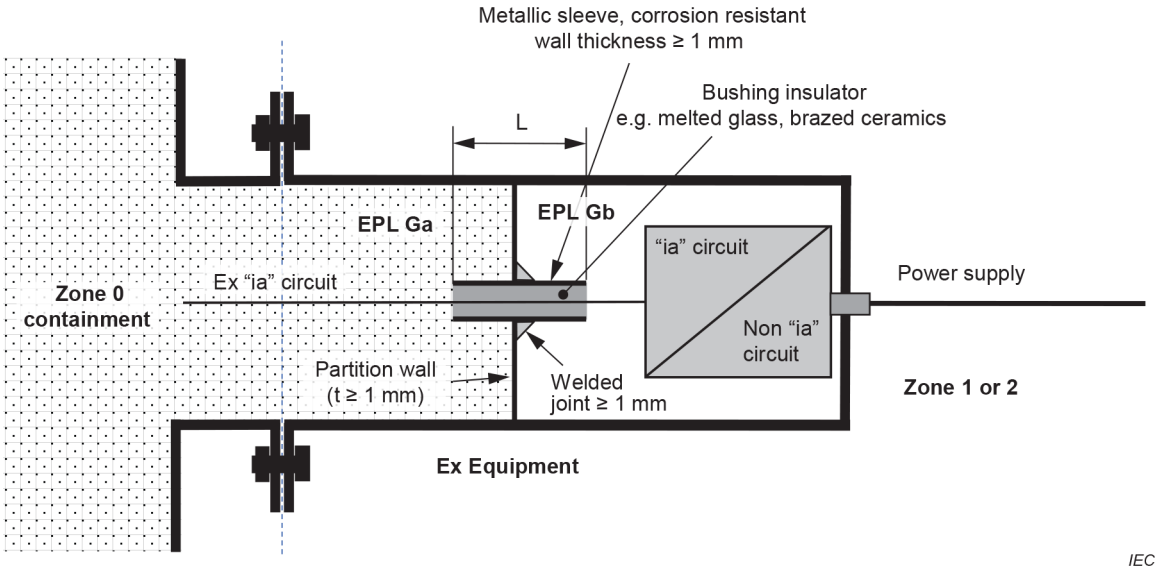

Figure 1 – Partition wall with a conductor bushing considered as gas diffusion tight

A bushing shall have a leakage rate equivalent to a helium-leakage rate of less than 10^{-2} Pa × l/s at a pressure difference of 10^5 Pa. A bushing consisting of a welded metallic sleeve with a length L ≥ 10 mm and an insulator of melted glass, brazed ceramics or epoxy resin as shown in Figure 1 is considered gas diffusion tight without testing.

NOTE Due to a low leakage rate through the bushing the probability that a critical concentration of explosive gas atmosphere is accumulated in the part complying with the lower EPL is reduced.

5.2.5 Partition wall supplemented with a joint

Joints supplementing partition walls for EPL Ga or Gb shall comply with either: a) or b);

a) the requirements in IEC 60079-1; the free volume of the enclosure containing the electrical circuits shall be used to determine the joint characteristics, non-transmission tests are not required;

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

Joints supplementing partition walls for EPL Da or Db shall comply with an IP rating according to IEC 60079-31 for dust containments (dust-tight joints).

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 statically loaded spring).

Non-metallic components in separation elements shall meet the requirements of IEC 60695-11-10, flammability category V-0. The material shall be specified in the instructions according to Clause 9.

5.2.6 Partition wall for explosive gas atmospheres supplemented 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 L ≥ 10 mm and the effective perforation in the circumference is at least 50 %. Metallic partition walls with a thickness greater than 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). The joint specifications shall be defined according to IEC 60079-1 for the minimum volume <100 cm^3 for the type of joints. In this case,

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the ventilation air gap shall have a minimum length of L = 10 mm or a length equal to the diameter of the shaft, whichever is greater.

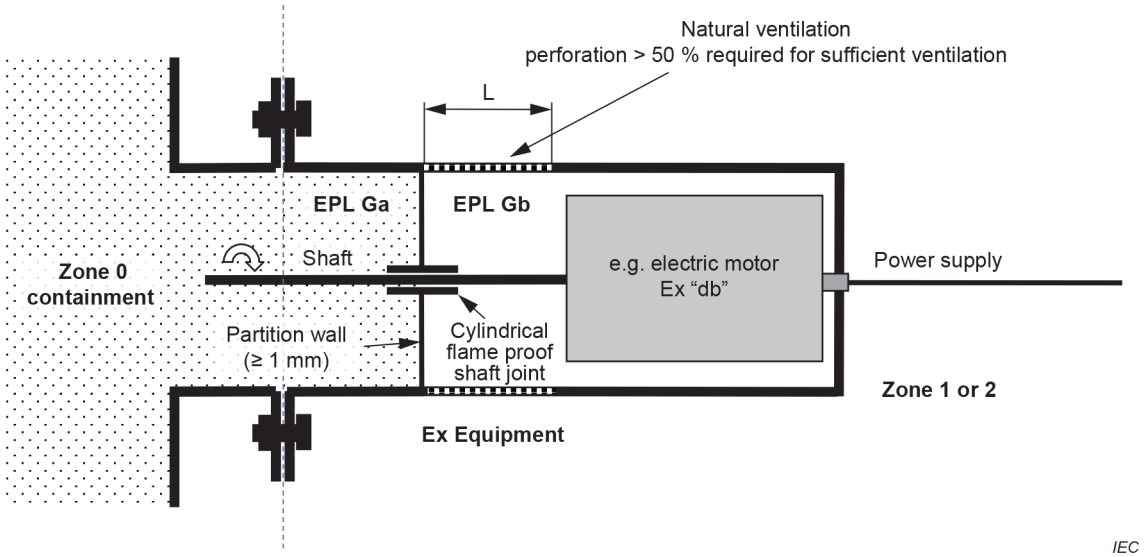

Figure 2 – Example of a separation element with a cylindrical shaft joint and ventilation

NOTE The cylindrical shaft joint inside the partition wall as shown in Figure 2 is not a supplementing joint as referred to in 5.2.5.

This example of a cylindrical shaft joint is suitable for low power applications, for example for instrumentation. For high power applications (for example an agitator) due to misalignment of the shaft and high rotational energy friction in the shaft joint could provide an ignition source and additional measures according to ISO 80079-36 shall apply for the construction.

5.2.7 Requirements depending on the thickness of the partition wall

No additional protection measures are required for homogeneous partition walls with a thickness greater than 3 mm.

NOTE 1 In the context of this clause, 'homogeneous' means a membrane constructed of a single piece of material without any insertions such as feed-throughs, or bushings. Welded joints are considered as homogeneous part of the partition wall.

For homogeneous partition walls of thickness ≤ 3 mm the following requirements apply:

– Partition walls of thickness ≥ 1 mm are considered to be infallible and not subject to fault.
– Partition walls of thickness < 1 mm and ≥ 0,2 mm are considered to fail as a rare malfunction.
– Partition walls of thickness < 0,2 mm are considered to fail as an expected malfunction.

A wall thickness less than 1 mm is only permitted in combination with intrinsically safe circuits, a flameproof joint, a dust-tight joint or natural ventilation (see Table A.1 to Table A.8).

NOTE 2 Without additional measures only Type of Protection intrinsic safety prevents electrical circuits from high energetic electrical sparks or arcs, which could damage a thin partition wall < 1 mm.

If the thickness of the partition wall is less than 1 mm, the certificate number shall include the "X" suffix in accordance with the marking requirements of IEC 60079-0, the certificate shall include the Specific Conditions of Use and the instructions shall indicate any conditions that the material shall not be subject to which may adversely affect the partition wall. Such conditions could be due to environmental, chemical or physical factors.

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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 Annex A.

i) For homogeneous partition walls with a thickness of 3 mm $> t \geq$ 1 mm, a Type of Protection according to Table A.1 to Table A.8 is required. A homogeneous part of the enclosure may form the partition wall, even for Types of Protection which rely on the enclosure.

   If the equipment contains a source of ignition in normal operation (for example, a relay), one Type of Protection is required in combination with:

   – either a flameproof joint (construction b) of Table A.1 and Table A.2), or

   – a ventilated air gap (construction c) of Table A.1 and Table A.2).

ii) For a partition wall of 1 mm $> t \geq$ 0,2 mm, one of the following protective measures is required:

   – Type of Protection intrinsic safety according to IEC 60079-11 (construction a) of Table A.1 to Table A.8); or

   NOTE 3 Without additional measures only Type of Protection intrinsic safety is provided to avoid high electric power, which could damage the separation element.

   NOTE 4 The equipment group and the temperature class of the Type of Protection intrinsic safety are only relevant for the containment.

   – Type of Protection in combination with a flameproof joint (construction b) of Table A.1, Table A.2, Table A.7 and Table A.8); or

   – Type of Protection in combination with a dust-tight joint (Table A.3 and Table A.4); or

   – Type of Protection in combination with a ventilated air-gap and a flameproof joint (construction c) of Table A.1 and Table A.2).

iii) For a partition wall with $t <$ 0,2 mm (for example, membranes) a Type of Protection according to Table A.1 to Table A.8 is required in combination with:

   – a flameproof joint, if the equipment contains no source of ignition in normal operation (construction b) of Table A.1 and Table A.2), or

   – a flameproof joint and a ventilated air gap, if the equipment contains a source of ignition in normal operation (for example, switching contacts, construction c) of Table A.1 and Table A.2).

6 Process connection

If the equipment is mounted across the boundary wall between different hazardous areas, the construction shall ensure that under normal operation conditions:

a) explosive gas atmospheres or explosive dust atmospheres cannot be released from one hazardous area to the other; and

b) that in case of an ignition of an explosive atmosphere in the surrounding area there is no flame propagation into the containment with higher EPL.

The equipment shall be designed to allow installation in a manner that will result in a sufficiently tight joint (IP66 or IP67 according to IEC 60529) or a flameproof joint according to IEC 60079-1 (joints specified for a volume ≤ 100 cm^3) between one hazardous area to the other.

EXAMPLE Equipment with an integrated separation element according to Clause 5 or with an IP67 rating according to IEC 60529 between the area requiring EPL Ga and the less hazardous area is considered suitable.

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

NOTE 1 It is not a requirement of this standard that compliance with the relevant industrial standards be verified.

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.

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If these requirements cannot be complied with, the certificate number shall include the "X" suffix in accordance with the marking requirements of IEC 60079-0, the certificate shall include the Specific Conditions of Use and the instructions shall contain a warning with appropriate measures according to 9.2.

EXAMPLE To enable chemical sampling at the open nozzle or for a rope guide of probes or for inspection purposes an opening is provided in the boundary wall between different hazardous areas.

7 Type tests

7.1 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 Types of Protection, with EPL Gb, according to Clause 4 are applied, both Types of Protection shall be tested independently.

7.2 Separation elements

Separation elements in accordance with Clause 5 shall be tested in such a way that the operational parameters (for example, pressure or temperature limits) stated by the manufacturer are verified.

NOTE For metallic, glass or ceramic partition walls it is not a requirement of this standard that compliance with the technical data of the manufacturer to be verified.

Partition walls according to 5.2.3 b) which are exposed to:

– operational pressure

  shall be subject to the thermal endurance test of IEC 60079-0 followed by a pressure test. The pressure test shall be performed at the maximum rated operational temperature and operational pressure applied from the process side to the partition wall at least 1 min without visible leakage.

– Constant vibrational stress

  shall have the specified vibrational endurance limit (cycles) verified with a pressure cycling according to IEC TS 60079-40 with the specified number of cycles. After the cycling test the maximum specified operational pressure shall be applied to the partition for at least 1 min without visible leakage.

7.3 Temperature evaluation

For the determination of the maximum surface temperature of the separation element, malfunctions according to the Type of Protection shall be taken into account.

8 Marking

8.1 General

These requirements supplement and modify the marking requirements of IEC 60079-0.

8.2 Ex Equipment with two combined Types of Protection

Where more than one Type of Protection is used to achieve EPL Ga in accordance with Clause 4, the symbols for the Levels of Protection shall be joined with a "+".

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