



UL 60079-1

STANDARD FOR SAFETY

Explosive Atmospheres – Part 1: Equipment
Protection by Flameproof Enclosures “d”

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UL Standard for Safety for Explosive Atmospheres – Part 1: Equipment Protection by Flameproof Enclosures “d”, UL 60079-1

Seventh Edition, Dated September 18, 2015

Summary of Topics

Adoption of IEC 60079-1, Explosive Atmospheres – Part 1: Equipment Protection by Flameproof Enclosures “d” (seventh edition, issued June 2014) as a new IEC-based UL standard, UL 60079-1 (IEC 60079-1:2014), with US National Differences.

The new revised requirements are substantially in accordance with Proposal(s) on this subject dated January 23, 2015 and May 22, 2015. For further information regarding Summary of Requirements, please visit <https://ifs.ul.com/ifr/ifr.nsf>.

THIS SEVENTH EDITION REPLACES THE SIXTH EDITION. AS OF OCTOBER 1, 2020, THE SIXTH EDITION OF UL 60079-1 WILL BE WITHDRAWN.

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SEPTEMBER 18, 2015

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ANSI/UL 60079-1-2015

UL 60079-1

**Standard for Explosive Atmospheres – Part 1: Equipment Protection by
Flameproof Enclosures “d”**

Seventh Edition

September 18, 2015

This ANSI/UL Standard for Safety consists of the Seventh Edition.

The most recent designation of ANSI/UL 60079-1 as an American National Standard (ANSI) occurred on September 18, 2015. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, Preface, or effective date information. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards. Any other portions of this ANSI/UL standard that were not processed in accordance with ANSI/UL requirements are noted at the beginning of the impacted sections.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <http://csds.ul.com>.

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PREFACE

This harmonized standard is based on IEC Publication 60079-1: 2014 edition, Explosive Atmospheres - Part 1: Equipment Protection by Flameproof Enclosures "d" issued 06-2014. IEC publication [IEC 60079-1] is copyrighted by the IEC.

This standard is considered suitable for use for conformity assessment within the stated scope of the standard.

This standard has been approved by the American National Standards Institute (ANSI) as an American National Standard.

Application of Standard

Where reference is made to a specific number of samples to be tested, the specified number is to be considered a minimum quantity.

Note: Although the intended primary application of this standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.

Level of Harmonization

This standard adopts the IEC text with national differences.

All national differences from the IEC text are included in the UL version of the standard. While the technical content is the same in UL's version, the format and presentation may differ.

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National Differences from the text of International Electrotechnical Commission (IEC) Publication 60079-1, Explosive Atmospheres – Part 1: Equipment Protection by Flameproof Enclosures “d”, (seventh edition, issued by IEC June 2014), are indicated by notations (differences) and are presented in bold text using legislative text (strike-out and underline).

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

The UL printed standard includes the national difference types within the body of the text.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are national differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE – These are National Differences based on **editorial comments or corrections**.

DR – These are National Differences based on the **national regulatory requirements**.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

EXPLOSIVE ATMOSPHERES – Part 1: Equipment protection by flameproof enclosures “d”

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 nongovernmental 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 60079-1 has been prepared by IEC technical committee 31: Equipment for explosive atmospheres.

This seventh edition cancels and replaces the sixth edition, published in 2007, and constitutes a technical revision.

The significance of the changes between IEC 60079-1, Edition 7.0 (2014) and IEC 60079-1 Edition 6.0 (2007) (including Corrigendum 1 (2008)), is as listed below:

Explanation of the significance of the changes	Clause	Type		
		Minor and editorial changes	Extension	Major technical changes
Normative references (Removal of the edition date from the reference for IEC 60079-0)	2	X		
Requirements for level of protection "da" (Catalytic sensors of portable combustible gas detectors)	4.2		X	
Requirements for level of protection "dc" ("Enclosed break" devices from IEC 60079-15)	4.4, 15.5	X		
Flameproof joints, General requirements (Documentation clarification and examples of corrosion inhibiting grease)	5.1	X		
Flameproof joints, General requirements (Specific Conditions of Use that joints are not intended to be repaired)	5.1		X	
Flameproof joints, General requirements (Electroplating more than 0,008 mm thick)	5.1		X	
Non-threaded joints, Gap (i) (Intentional gaps between surface for flanged joints)	5.2.2	X		
Serrated joints (Use and test requirements)	5.2.8	X		
Multi-step joints (Not less than 3 adjacent segments and two path changes)	5.2.9		X	
Minimum width of joint and maximum gap for enclosures of groups IIA and IIB (Maximum gaps for flanged, cylindrical or spigot joints of 9,5 mm minimum width and volume greater than 2 000 cm ³)	Table 2		X	
Minimum width of joint and maximum gap for enclosures of groups I, IIA, IIB and IIC (ISO 80000-1 for constructional value rounding)	Table 2, Table 3	X		
Cylindrical threaded joints (ISO 965-1 standard in respect of thread form or quality of fit)	Table 4	X		
Taper threaded joints (External and internal thread construction)	Table 5	X		
Cemented joints (Supplemental mechanical means of securement)	6.1.2			C1
Cemented joints (Evaluation criteria if there is leakage)	6.1.2		X	
Fused glass joints (Glass-to-metal joints)	6.2		X	
Thermal tests of breathing and draining devices (Temperature class based on external surface temperature after the 10 min test period)	10.9.3.2	X		

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Explanation of the significance of the changes	Clause	Type		
		Minor and editorial changes	Extension	Major technical changes
Test of the ability of the breathing and draining device to withstand pressure (Relocated from before thermal tests to after the non-transmission test)	10.9.3.4	X		
Ex component certificate (Service temperature range for non-metallic enclosures per IEC 60079-0)	10.9.4	X		
Fasteners and openings (Relocation of blanking element content to 13.8 and C.2.3)	11	X		
Fasteners and openings, Property class or yield stress (Certificate specific condition of use)	11.3	X		
Fasteners and openings (Openings in the wall of the enclosure)	11.8	X		
Materials (Material limitation in acetylene atmospheres)	12.8			C2
Entries for flameproof enclosures, General (Metric and NPT threaded entries)	13.1	X		
Entries for flameproof enclosures, General (Group I non-threaded joints)	13.1		X	
Entries for flameproof enclosures, Non-threaded holes (Group I application)	13.3		X	
Entries for flameproof enclosures, Cable glands (Group I application)	13.4		X	
Cable glands, Conduit sealing devices (Documentation to facilitate mounting)	13.4, 13.5	X		
Plugs and sockets and cable couplers (Load requirement for arc-quenching test)	13.6.4			C3
Bushings (Documentation to facilitate mounting)	13.7	X		
Blanking elements (Relocated from Clause 11)	13.8	X		
Verification and tests (Maximum surface temperature conditions)	Table 6	X		
Type tests (Sequence and number of samples for tests)	15	X		
Determination of explosion pressure, General (Devices that can cause turbulence)	15.2.2.2	X		
Determination of explosion pressure, General (Number of tests for Group IIC)	15.2.2.2	X		
Determination of explosion pressure, General (Pressure pilling for Group IIB)	15.2.2.4	X		
Determination of explosion pressure, General (Equipment marked for a single gas)	15.2.2.5DV.1	X		

Table Continued

Explanation of the significance of the changes	Clause	Type		
		Minor and editorial changes	Extension	Major technical changes
Overpressure test, General (Low ambient overpressure tests not required)	15.2.3	X		
Overpressure test – First method (static) (3 times option when routine batch testing)	15.2.3.2		X	
Overpressure test – First method (static) (Adjustment for low ambient due to small size of equipment)	15.2.3.2		X	
Overpressure test – Second method (dynamic) (Number of tests to be made)	15.2.3.3	X		
Test for non-transmission of an internal ignition (Clarification regarding grease)	15.3	X		
Reduction in length of a threaded joint for non-transmission test (ISO 965-1 and 965-3 standards in respect of thread form and quality of fit)	Table 9	X		
Test factors to increase pressure or test gap (Group IIC adjustments for elevated ambients)	Table 10	X		
Test for non-transmission of an internal ignition, Groups I, IIA and IIB (Number of tests to be made)	15.3.2.3	X		
Test for non-transmission of an internal ignition, Group IIC testing by increased gap (Number of tests to be made)	15.3.3.2	X		
Test for non-transmission of an internal ignition, Group IIC (Oxygen enrichment of test gases)	15.3.3.4		X	
Thermal tests of enclosures with breathing and draining devices (Temperature class based on external surface temperature after the 10 min test period)	15.4.3.1	X		
Tests for “dc” devices (“Enclosed break” devices from IEC 60079-15)	15.5		X	
Routine tests, General (Adjustment for low ambient due to small size of equipment)	16.1.2		X	
Routine tests, General (Options when second method is chosen)	16.1.3	X		
Routine tests, General (Welded joint inspection options)	16.3		X	
Routine tests, General (Allowance for batch testing)	16.6		X	
Switchgear for Group I (Clarifying need for compliance with EPL Mb types of protection)	17.2.2, 17.2.3	X		
Non-metallic enclosures and non-metallic parts of enclosures, General (Exception for cemented joints)	19.1	X		

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		Minor and editorial changes	Extension	Major technical changes
Non-metallic enclosures and non-metallic parts of enclosures, Resistance to tracking and creepage distances (Reference to both IEC 60079-7 and or IEC 60079-15)	19.2		X	
Non-metallic enclosures and non-metallic parts of enclosures, Requirements for type tests (Clarification of test sequence)	19.3	X		
Instructions (Indication that repair of flamepaths is not intended)	21		X	
Bushings (Documentation regarding numbers of cores)	C.2.1.4	X		
Bushings (Criteria for non-transmission test)	C.2.1.4	X		
Bushings (Evaluation criteria if there is leakage)	C.2.1.4		X	
Flameproof joints, Threaded joints (Requirement options)	C.2.2.1	X		
Flameproof joints, Non-threaded joints (Group I application)	C.2.2.2		X	
Constructional requirements for Ex blanking elements (Relocated from Clause 11)	C.2.3.1	X		
Constructional requirements for Ex blanking elements (Metric and NPT Ex blanking elements)	C.2.3.2, C.2.3.3	X		
Constructional requirements for Ex blanking elements (Group I non-threaded construction)	C.2.3.4		X	
Sealing test, General (Allowance for re-tightening)	C.3.1.1	X		
Cable glands and conduit sealing devices with sealing ring (Mandrel to be corrosion-resistant metal)	C.3.1.2	X		
Type tests for Ex blanking elements, Torque test (Test-block to be steel)	C.3.3.1	X		
Tightening torque values (Addition of < 16 mm thread size)	Table C.1		X	
Tightening torque values (Addition of NPT thread sizes)	Table C.2		X	
Ex component enclosure requirements (Markings content)	D.3.8			C4
Ex component enclosure requirements (Certificate content)	D.3.10		X	
Utilization of an Ex component enclosure certificate to prepare an equipment certificate, Procedure (Devices that can create significant turbulence)	D.4.1		X	

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		Minor and editorial changes	Extension	Major technical changes
Acceptable primary cells (Addition of Type B cells)	Table E.1		X	
Acceptable primary cells (Removal of Type T cells)	Table E.1			C5
Acceptable secondary cells (Addition of Lithium type cells)	Table E.2		X	
Prevention of excessive temperature and cell damage (Application of IEC 60079-11 requirement)	E.4.1.2	X		
Prevention of inadvertent charging of a battery by other voltage sources in the enclosure (Construction not requiring additional protection)	E.4.3		X	
Recharging of secondary cells inside flameproof enclosures (Additional battery options)	E.5.1		X	
Introduction of an alternative risk assessment method encompassing equipment protection levels' for Ex equipment (Removal of previous Informative Annex)	Annex G	X		
Additional requirements for Flameproof enclosures with an internal source of release (containment system) (Addition of new Normative Annex)	Annex G		X	
Requirements for machines with flameproof "d" enclosures fed from converters (Addition of new Normative Annex)	Annex H		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. More guidance can be found by referring to the Redline Version of the standard.

Explanations:

A) Definitions

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.

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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.

Major technical changes

addition of technical requirements

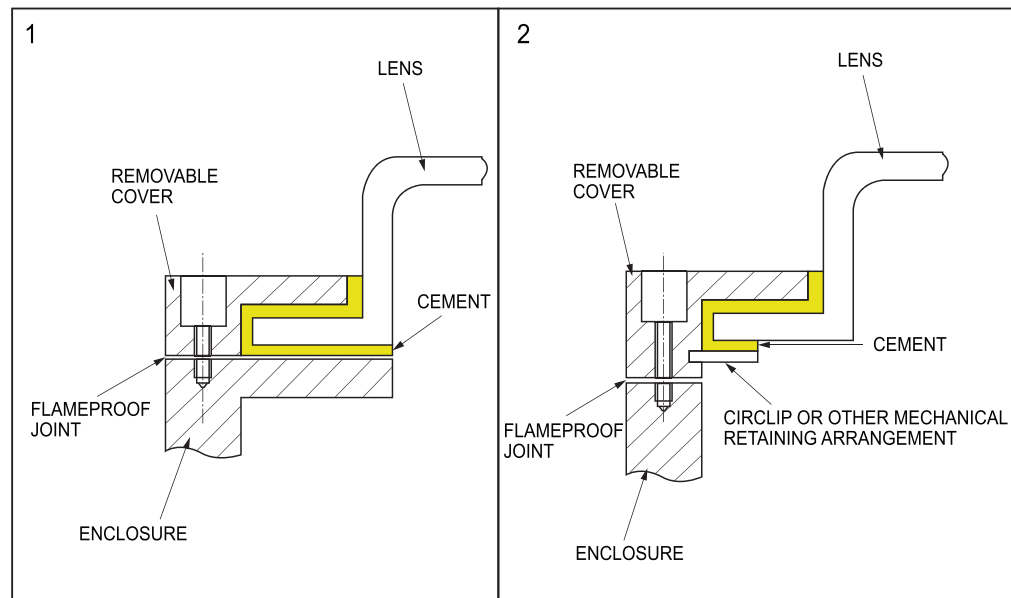
increase of technical requirements

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 – Supplemental mechanical means of securing the cemented joint shall not be defeated by the opening of doors or covers that are intended to be opened during installation or maintenance. For example, in the images below for a luminaire incorporating a cemented joint between the lens and the enclosure cover, the construction shown in the second image would be in accordance with this requirement, while the construction shown in the first image would not.



su1966

IEC 1932/14

C2 – Addition of material limitations of enclosures of equipment and enclosures of Ex components for external mounting, if constructed of copper or copper alloys, when used in explosive gas atmospheres containing acetylene (12.8).

C3 – Addition of power factor requirement for evaluating the ability of a plug and socket to remain flameproof during the arc-quenching period while opening a test circuit (13.6.4).

C4 – Addition of marking requirements for Ex component enclosures, in addition to the requirements for marking of Ex components given in IEC 60079-0 (D.3.8).

C5 – Removal of Type T cells as acceptable primary cells (Table E.1).

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

FDIS	Report on voting
31/1111/FDIS	31/1125/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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

EXPLOSIVE ATMOSPHERES – Part 1: Equipment protection by flameproof enclosures “d”

1 Scope

1DV.1 DR Modification of Clause 1, first paragraph to replace with the following:

1DV.1.1 This ~~part of IEC 60079 standard~~ contains specific requirements for the construction and testing of electrical equipment with the type of protection flameproof enclosure “d”, intended for use in explosive gas atmospheres.

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 will take precedence.

1DV.2 DR Addition of 1DV.2.1

1DV.2.1 Where references are made to IEC 60079 standards, the referenced requirements found in these standards shall apply as modified by any applicable U.S. National Differences.

2 Normative references

2DV D1 Modification of Clause 2 references to replace with the following:

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 60061 (all parts), Lamp caps and holders together with gauges for the control of interchangeability and safety

~~IEC 60079-0, Explosive atmospheres – Part 0: Equipment – General requirements~~

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

~~IEC 60079-11, Explosive atmospheres – Part 11: Equipment protection by intrinsic safety “i”~~

~~IEC 60079-15, Explosive atmospheres – Part 15: Equipment protection by type of protection “n”~~

IEC 60127 (all parts), Miniature fuses

ISA 60079-0, Explosive atmospheres – Part 0: Equipment – General requirements

ISA 60079-7, Explosive atmospheres – Part 7: Equipment protection by increased safety “e”

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ISA 60079-11, Explosive atmospheres – Part 11: Equipment protection by intrinsic safety “i”

ISA 60079-15, Explosive atmospheres – Part 15: Equipment protection by type of protection “n”

ISO 965-1, ISO general-purpose metric screw threads – Tolerances – Part 1: Principles and basic data

ISO 965-3, ISO general-purpose metric screw threads – Tolerances – Part 3: Deviations for constructional screw threads

ISO 2738, Sintered metal materials, excluding hardmetals – Permeable sintered metal materials – Determination of density, oil content and open porosity

ISO 4003, Permeable sintered metal materials – Determination of bubble test pore size

ISO 4022, Permeable sintered metal materials – Determination of fluid permeability

ANSI/ASME B1.20.1, Pipe threads, general purpose (inch)

UL 94 Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

UL 2225 Metal-Clad Cables and Cable-Sealing Fittings for Use in Hazardous (Classified) Locations

UL 60079-0 Explosive Atmospheres Part 0: Equipment – General Requirements

UL 60079-7 Explosive Atmospheres – Part 7: Equipment Protection by Increased Safety “e”

UL 60079-11 Explosive Atmospheres – Part 11: Equipment Protection by Intrinsic Safety “i”

UL 60079-15 Explosive Atmospheres – Part 15: Equipment Protection by Type of Protection “n”

3 Terms and definitions

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

NOTE Additional definitions applicable to explosive atmospheres can be found in IEC 60050-426 [1]¹.

¹ References in square brackets refer to the bibliography.

3.1 flameproof enclosure “d” enclosure in which the parts which can ignite an explosive gas atmosphere are placed and which can withstand the pressure developed during an internal explosion of an explosive mixture, and which prevents the transmission of the explosion to the explosive gas atmosphere surrounding the enclosure

3.2 **volume** total internal volume of the enclosure

Note 1 to entry: For enclosures in which the contents are essential in service, the volume to be considered is the remaining free volume.

Note 2 to entry: For luminaries, the volume is determined without lamps fitted.

3.3 **flameproof joint or flamepath** place where the corresponding surfaces of two parts of an enclosure, or the conjunction of enclosures, come together and which prevents the transmission of an internal explosion to the explosive gas atmosphere surrounding the enclosure

3.4 **width of flameproof joint L** shortest path through a flameproof joint from the inside to the outside of an enclosure

Note 1 to entry: This definition does not apply to threaded joints.

3.5 **distance I** shortest path through a flameproof joint, when the width of the flameproof joint L is interrupted by holes intended for the passage of fasteners for assembling the parts of the flameproof enclosure

3.6 **gap of flameproof joint i** distance between the corresponding surfaces of a flameproof joint when the electrical apparatus enclosure has been assembled

Note 1 to entry: For cylindrical surfaces, forming cylindrical joints, the gap is the difference between the diameters of the bore and the cylindrical component.

3.7DV DE Modification of Clause 3.7 to replace with the following:

maximum experimental safe gap (for an explosive mixture) $MESG$ maximum gap of a joint of 25 mm in width which prevents any transmission of an explosion during 10 tests made under the conditions specified in IEC 60079-20-1 [2]

NOTE 1 to entry: ANSI/NFPA 497 also includes information on ($MESG$) including a table of values.

3.8 **shaft** part of circular cross-section used for the transmission of rotary movement

3.9 **operating rod** part used for the transmission of control movements which may be rotary or linear or a combination of the two

3.10 **pressure-piling** results of an ignition, in a compartment or subdivision of an enclosure, of a gas mixture pre-compressed, for example, due to a primary ignition in another compartment or subdivision

3.11 **quick-acting door or cover** door or cover provided with a device which permits opening or closing by a simple operation, such as the movement of a lever or the rotation of a wheel

Note 1 to entry: The device is arranged so that the operation has two stages:

- one for locking or unlocking, and
- another for opening or closing.

3.12 door or cover fixed by threaded fasteners door or cover, the opening or closing of which requires the manipulation of one or more threaded fasteners (screws, studs, bolts or nuts)

3.13 threaded door or cover door or cover which is assembled to a flameproof enclosure by a threaded flameproof joint

3.14 breathing device device which permits an exchange between the atmosphere within an enclosure and the surrounding atmosphere and which maintains the integrity of the type of protection

3.15 draining device device which permits liquids to flow out from an enclosure and which maintains the integrity of the type of protection

3.16DV DR Modification of Clause 3.16 to replace with the following:

3.16.1DV Ex equipment blanking element threaded blanking elements for Group I or II, and non-threaded blanking elements for Group I, that

- are intended to close unused entries,
- are tested separately from the equipment enclosure,
- have an equipment certificate, and
- are intended to be fitted to the equipment enclosure without further consideration

Note 1 to entry: This does not preclude a component certificate for Ex component blanking elements in accordance with IEC UL 60079-0. ~~Examples of blanking elements are shown in Figure C.1.~~

Note 2 to entry: Non-threaded blanking elements are not equipment for Group II applications.

3.17 Ex equipment thread adapter thread adapter tested separately from the enclosure but having an equipment certificate and which is intended to be fitted to the equipment enclosure without further consideration

Note 1 to entry: This does not preclude a component certificate for Ex component thread adapters in accordance with IEC 60079-0. Examples of thread adapters are shown in Figure C.3.

3.18 Ex component enclosure empty flameproof enclosure provided with an Ex component certificate, without the internal equipment being defined, so as to enable the empty enclosure to be made available for incorporation into an equipment certificate without the need for repetition of type testing

4 Level of protection (equipment protection level, EPL)

4.1 General

Electrical equipment with flameproof enclosure “d” shall be one of the following:

- level of protection “da” (EPL “Ma” or “Ga”);
- level of protection “db” (EPL “Mb” or “Gb”); or
- level of protection “dc” (EPL “Gc”).

The requirements of this standard shall apply to all levels of protection unless otherwise stated.

4.2 Requirements for level of protection “da”

Level of protection “da” is only applicable to catalytic sensors of portable combustible gas detectors.

The following are the additional specific requirements for level of protection “da” that modify or supplement the requirements of this standard:

- the maximum free internal volume shall not exceed 5 cm³;
- the electrical conductors into the sensor shall employ a sealed joint, in accordance with Clause 6, directly in the wall of the enclosure;
- the breathing device of the sensor shall comply with Clause 10, and shall be bonded to the wall of the enclosure so as to eliminate any gaps (such as cementing per 6.1 or sinter bonding) or shall be press-fitted to the wall of the enclosure with supplemental mechanical means of securing (such as swaging);
- supplied by a circuit of Level of Protection “ia”, with a maximum dissipated power limited to 3,3 W for Group I and 1,3 W for Group II; and

NOTE Catalytic elements operate normally at a high temperature. If the power dissipation is increased beyond normal operating levels, the element fails to an open circuit. Therefore, the required power limitation provides a limitation of the external surface temperature.

- the non-transmission tests of 15.3 or 15.4.4 (if applicable) are modified to increase the number of non-transmission tests as shown in Table 1.

Table 1 – Number of non-transmission tests for level of protection “da”

Equipment group	Number of non-transmission tests
I	50
IIA	50
IIB	50
IIC	50 hydrogen and 50 acetylene

4.3 Requirements for level of protection “db”

Other than specific requirements for level of protection “da” and “dc”, all other requirements of this standard shall apply to level of protection “db”.

4.4 Requirements for level of protection “dc”

4.4.1 General

The requirements for level of protection “dc” are applicable to electrical equipment and Ex components with electrical switching contacts and are found in 4.4.2 through 4.4.3.

4.4.2 Construction of “dc” devices

4.4.2.1 General

The requirements of 4.4.2.2 through 4.4.2.5 replace those of Clause 5 through Clause 13. For equipment in level of protection “dc” that is intended for connection to field wiring, Clause 13 applies.

4.4.2.2 Free internal volume

The free internal volume shall not exceed 20 cm³.

4.4.2.3 Seal protection

Enclosures for level of protection “dc” that do not serve as the external equipment enclosure shall be capable of withstanding normal handling and assembly operations without damage to seals. When the enclosure for level of protection “dc” also serves as the external equipment enclosures, the enclosure requirements of IEC 60079-0 apply.

4.4.2.4 Continuous operating temperature (COT) requirements

Poured seals and encapsulating compounds shall have a continuous operating temperature (COT) range that includes a minimum temperature that is below, or equal to, the minimum service temperature and a maximum temperature that is at least 10 K above the maximum service temperature.

4.4.2.5 Ratings

Devices shall be limited to a maximum rating of 690 V a.c., r.m.s. or d.c. and 16 A a.c. r.m.s. or dc.

4.4.3 Tests for “dc” devices

For devices involving level of protection “dc”, components shall be subjected to the type test specified in 15.5. After the test, the device or component shall show no visible signs of damage, no external ignition shall occur, and there shall be no failure to clear the arc when the switch contacts are opened.

5 Flameproof joints

5.1 General requirements

5.1DV.1 DR *Modification of Clause 5.1, to replace with the following:*

All flameproof joints, whether permanently closed or designed to be opened from time to time, shall comply, in the absence of pressure, with the appropriate requirements of Clause 5.

The design of joints shall be appropriate to the mechanical constraints applied to them.

The dimensions given in 5.2 to 5.5 specify the essential parameters of flamepaths. In instances where any of the following apply (for example, in order to comply with the test for non-transmission of an internal ignition):

- the minimum length of the flameproof joint as stated by the documentation is greater than the relevant minimum; or
- the maximum gap of the flameproof joint as stated by the documentation is less than the relevant maximum; or
- the minimum number of threads engaged for the flameproof joint as stated by the documentation is more than the relevant minimum;

NOTE 1 IEC UL 60079-0 defines the documentation as the documents that give a full and correct specification of the explosion safety aspects of the electrical equipment.

~~the equipment certificate number shall include the “X” suffix in accordance with the shall be marked according to marking requirements of IEC UL 60079-0 to indicate that there are and the specific conditions of use listed in the instructions on the certificate and in the, The instructions shall detail one of the following:~~

- dimensions of the flameproof joints shall be detailed; or
- specific drawing referenced that details the dimensions of the flameproof joints; or
- specific guidance noted to contact the original manufacturer for information on the dimensions of the flameproof joints; or
- specific indication that the flameproof joints are not intended to be repaired.

NOTE 2 IEC UL 60079-0 permits the use of an advisory marking on the equipment as an alternative to the conditions of use in the instructions for the requirements for the "X" marking.

The surface of joints may be protected against corrosion.

Coating with paint or powder-coat finish is not permitted. Other coating material may be used if the material and application procedure have been shown not to adversely affect the flameproof properties of the joint.

Corrosion inhibiting grease, such as petrolatum or soap-thickened mineral oils, may be applied to joint surfaces before assembly. The grease, if applied, shall be of a type that does not harden because of ageing, does not contain an evaporating solvent, and does not cause corrosion of the joint surfaces. Verification of suitability shall be in accordance with the grease manufacturer's specifications.

Joint surfaces may be electroplated. The metal plating, if applied, shall be in accordance with the following:

- if not more than 0,008 mm thick, no additional consideration is necessary;
- if more than 0,008 mm thick, then the maximum gap without the plating shall still be in accordance with the applicable joint requirements, and shall be tested for flame transmission based on the gap dimension that would exist without the plating.

Note: Anodizing of aluminum enclosures is not considered to be plating.

A thread locking compound shall be permitted as a sealant on threaded joints that are not intended to be opened after assembly.

5.2 Non-threaded joints

5.2.1 Width of joints (L)

The width of joints shall not be less than the minimum values given in Tables 2 and 3.

The width of joints for cylindrical metallic parts press-fitted into the walls of a metallic flameproof enclosure of a volume not greater than 2 000 cm³ may be reduced to 5 mm, if

- a) the design does not rely only on an interference fit to prevent the part being displaced during the type tests of Clause 15,
- b) the assembly meets the impact test requirements of IEC 60079-0, taking the worst-case interference fit tolerances into account, and
- c) the external diameter of the press-fitted part, where the width of the joint is measured, does not exceed 60 mm.

NOTE There is no prohibition of press-fit combinations of other than metallic parts into metallic flameproof enclosures. In these other combinations, the minimum width of joint requirements of Tables 2 or 3 apply.

5.2.2 Gap (i)

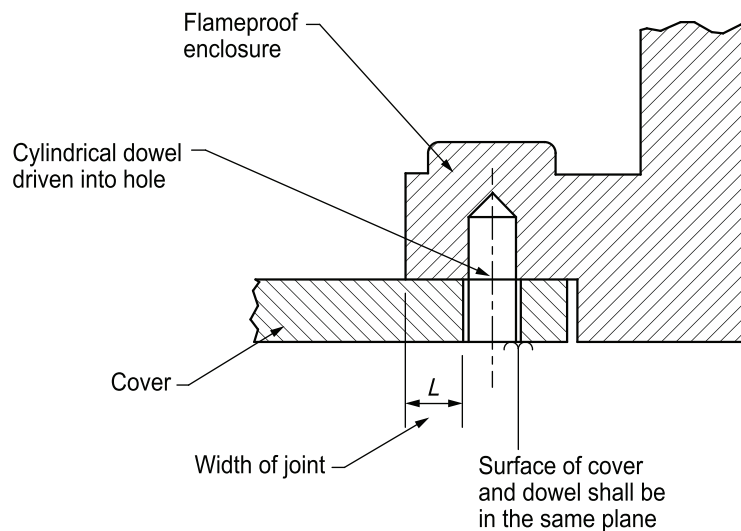
The gap, if one exists, between the surfaces of a joint shall nowhere exceed the maximum values given in Tables 2 and 3.

The surfaces of joints shall be such that their average roughness R_a does not exceed 6,3 μm .

NOTE Average roughness is derived from ISO 468. Determination can be made by visual comparison to a reference plate.

For flanged joints of other than quick-acting doors or covers, there shall be no intentional gap between the surfaces other than that created by the flatness tolerances of the mating parts.

For electrical equipment of Group I, it shall be possible to check, directly or indirectly, the gaps of flanged joints of covers and doors designed to be opened from time to time. Figure 1 shows an example of construction for indirect checking of a flameproof joint.



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IEC 1933/14

Figure 1 – Example of construction for indirect checking of a flanged Group I flameproof joint

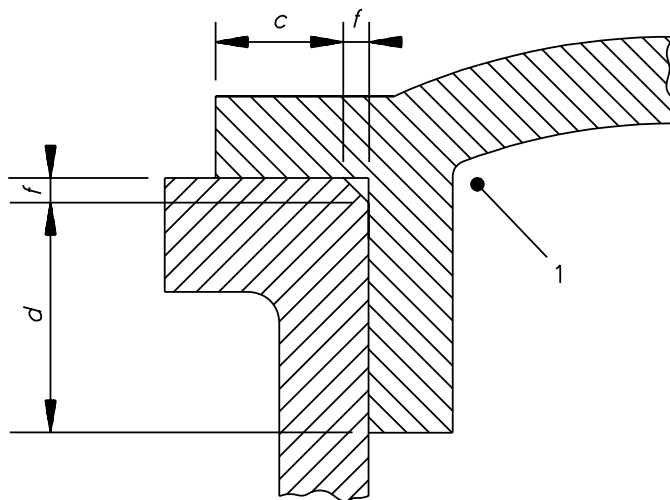
5.2.3 Spigot joints

For the determination of the width L of spigot joints, one of the following shall be taken into account:

– the cylindrical part and the plane part (see Figure 2a). In this case, the gap shall nowhere exceed the maximum values given in Tables 2 and 3; or

– the cylindrical part only (see Figure 2b). In this case, the plane part need not comply with the requirements of Tables 2 and 3.

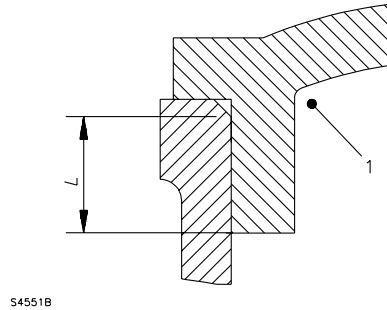
NOTE For gaskets, see also 5.4.



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IEC 1900/14

Figure 2a – Cylindrical part and plane part



IEC 1901/14

Figure 2b – Cylindrical part only

Key

- $L = c + d$ (I, IIA, IIB, IIC)
- $c \geq 6,0$ mm (IIC)
- $\geq 3,0$ mm (I, IIA, IIB)
- $d \geq 0,50 L$ (IIC)
- $f \leq 1,0$ mm (I, IIA, IIB, IIC)
- 1 interior of enclosure

Figure 2 – Spigot joints

5.2.4 Holes in joint surfaces

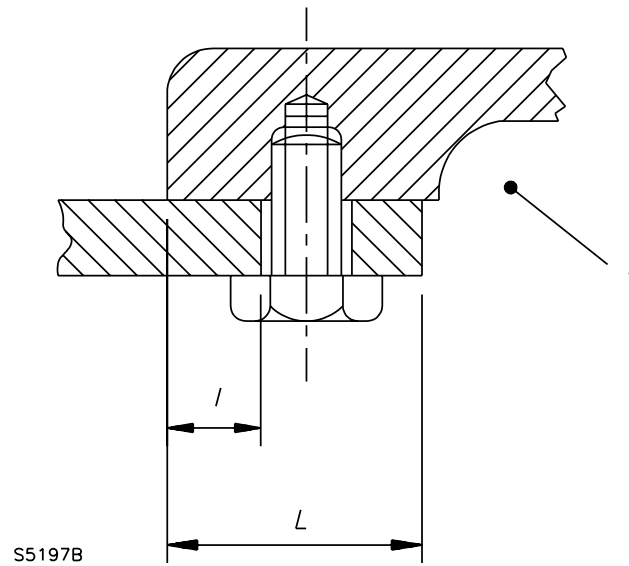
5.2.4.1 General

Where a plane joint or the plane part or partial cylindrical surface (see 5.2.6) of a joint is interrupted by holes intended for the passage of threaded fasteners for assembling the parts of a flameproof enclosure, the distance l to the edge of the hole shall be equal to or greater than

- a) 6 mm when the width of joint L is less than 12,5 mm,
- b) 8 mm when the width of joint L is equal to or greater than 12,5 mm but less than 25 mm,
- c) 9 mm when the width of joint L is equal to or greater than 25 mm.

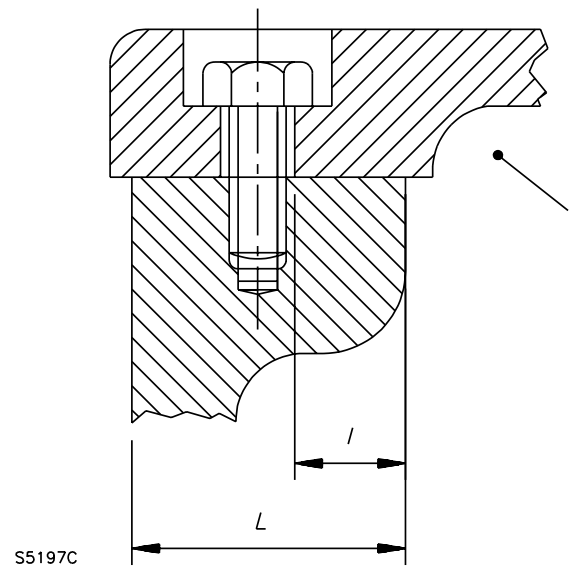
NOTE The requirements for clearance holes of fasteners are specified in IEC 60079-0.

The distance l is determined as follows.



IEC 1903/14

Figure 4 – Holes in surfaces of flanged joints, example 2



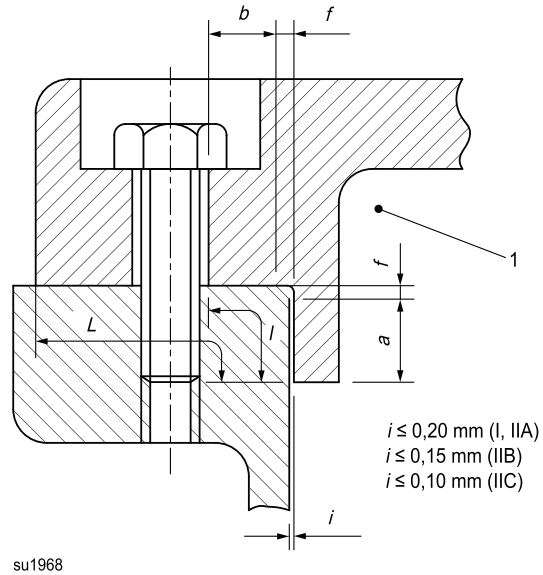
IEC 1904/14

Figure 5 – Holes in surfaces of flanged joints, example 3

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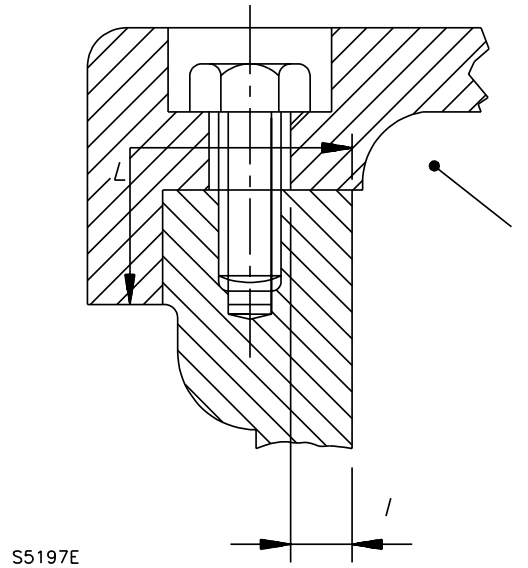


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IEC 1905/14

Figure 6 – Holes in surfaces of spigot joints, example 1

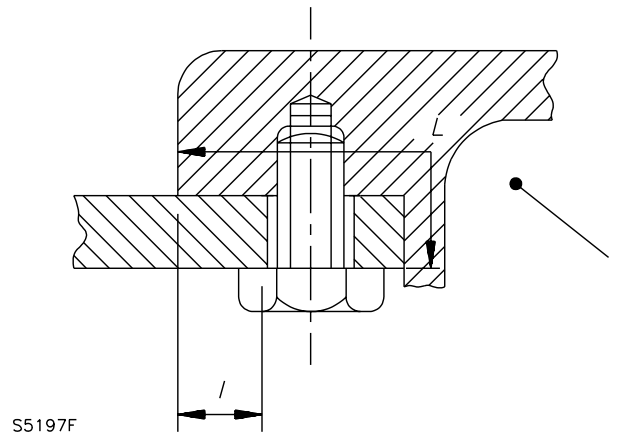


IEC 1906/14

Figure 7 – Holes in surfaces of spigot joints, example 2

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IEC 1907/14

Key

1 interior of enclosure

Figure 8 – Holes in surfaces of spigot joints, example 3

5.2.4.5 Spigot joints where, to the edges of the holes, the joint consists only of the plane part (see Figures 7 and 8), in so far as plane joints are permitted (see 5.2.7)

The distance l is the width of the plane part between the inside of the enclosure and a hole, where the hole is outside the enclosure (see Figure 7), or between a hole and the outside of the enclosure where the hole is inside the enclosure (see Figure 8).

5.2.5 Conical joints

Where joints include conical surfaces, the width of the joint and the gap normal to the joint surfaces shall comply with the relevant values in Table 2 and Table 3. The gap shall be uniform through the conical part. For electrical equipment of Group IIC, the cone angle shall not exceed 5° .

NOTE The cone angle is taken to be the angle between the major axis of the cone and the surface of the cone.