

Electrical apparatus for explosive gas atmospheres —

Part 1: Flameproof enclosures 'd'

The European Standard EN 60079-1:2004 has the status of a
British Standard

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National foreword

This British Standard is the official English language version of EN 60079-1:2004, including Corrigendum March 2004 and Corrigendum April 2006. It is identical with IEC 60079-1:2003. It supersedes BS EN 50018:2000 which remains current as obsolescent but will be withdrawn no later than 1 March 2007.

The UK participation in its preparation was entrusted by Technical Committee GEL/31, Electrical apparatus for use in explosive atmospheres, to Subcommittee GEL/31/12, Flameproof enclosures, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

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Electrical apparatus for explosive gas atmospheres
Part 1: Flameproof enclosures 'd'
(IEC 60079-1:2003)

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explosives gazeuses
Partie 1: Enveloppes antidéflagrantes 'd'
(CEI 60079-1:2003)

Elektrische Betriebsmittel für
gasexplosionsgefährdete Bereiche
Teil 1: Druckfeste Kapselung 'd'
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CENELEC

European Committee for Electrotechnical Standardization
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Foreword

The text of document 31A/114/FDIS, future edition 5 of IEC 60079-1, prepared by SC 31A, Flameproof enclosures, of IEC TC 31, Electrical apparatus for explosive atmospheres, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60079-1 on 2004-03-01.

This European Standard supersedes EN 50018:2000 + A1:2002.

This standard is to be read in conjunction with EN 60079-0.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2004-12-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2007-03-01

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

Annexes ZA and ZZ have been added by CENELEC.

The contents of the corrigendum of April 2006 have been included in this copy.

Endorsement notice

The text of the International Standard IEC 60079-1:2003 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 61508 NOTE Harmonized in EN 61508 series (not modified).

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ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES –

Part 1: Flameproof enclosures “d”

1 Scope

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

2 Normative references

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

IEC 60034-1:1996, *Rotating electrical machines – Part 1: Rating and performance*

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

IEC 60079-0:1998, *Electrical apparatus for explosive gas atmospheres – Part 0: General requirements*

IEC 60079-1-1:2002, *Electrical apparatus for explosive gas atmospheres – Part 1-1: Flameproof enclosures “d” – Method of test for ascertainment of maximum experimental safe gap*

IEC 60079-7:2001, *Electrical apparatus for explosive gas atmospheres – Part 7: Increased safety “e”*

IEC 60079-11:1999, *Electrical apparatus for explosive gas atmospheres – Part 11: Intrinsic safety “i”*

IEC 60086-1:2000, *Primary batteries – Part 1: General*

IEC 60112:1979, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60127 (all parts), *Miniature fuses*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60707:1981, *Flammability of solid non-metallic materials when exposed to flame sources – List of test methods*

ISO 185:1988, *Grey cast iron – Classification*

ISO 965-1:1998, *ISO general-purpose metric screw threads – Tolerances – Part 1: Principles and basic data*

ISO 965-3:1998, *ISO general-purpose metric screw threads – Tolerances – Part 3: Deviations for constructional threads*

ISO 1210:1982, *Plastics – Determination of the burning behaviour of horizontal and vertical specimens in contact with a small-flame ignition source*

ISO 2738:1999, *Sintered metal materials, excluding hard metals – Permeable sintered metal materials – Determination of density, oil content and open porosity*

ISO 4003:1977, *Permeable sintered metal materials – Determination of bubble test pore size*

ISO 4022:1987, *Permeable sintered metal materials – Determination of fluid permeability*

ISO 6892:1998, *Metallic materials – Tensile testing at ambient temperature*

ANSI/ASME B1.20.1-1983 (R2001), *Pipe threads, general purpose (inch)*

3 Terms and definitions

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

3.1

flameproof enclosure “d”

enclosure in which the parts which can ignite an explosive 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 atmosphere surrounding the enclosure

3.2

volume

total internal volume of the enclosure. However, for enclosures in which the contents are essential in service, the volume to be considered is the remaining free volume

NOTE For luminaires, the volume is determined without lamps fitted.

3.3

flameproof joint

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 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

3.5

distance

l

shortest path through a flameproof joint, when the width of the 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 For cylindrical surfaces, forming cylindrical joints, the gap is the difference between the diameters of the bore and the cylindrical component.

3.7**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 60079-1-1

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. The device is arranged so that the operation has two stages:

- one for locking or unlocking;
- 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**

integral or separable part of a flameproof enclosure designed to permit exchange between the atmosphere inside the enclosure and the surrounding atmosphere

3.15**draining device**

integral or separable part of a flameproof enclosure designed to permit water formed by condensation to escape from the enclosure

3.16

Ex blanking element

threaded blanking element tested separately from the apparatus enclosure but having an apparatus certificate and which is intended to be fitted to the apparatus enclosure without further consideration

NOTE 1 This does not preclude a component certificate for blanking elements in accordance with IEC 60079-0. Examples of blanking elements are shown in Figure 22.

NOTE 2 Non-threaded blanking elements are not apparatus.

3.17

Ex thread adapter

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

NOTE This does not preclude a component certificate for thread adapters in accordance with IEC 60079-0. Examples of thread adapters are shown in Figure C.2.

4 Apparatus grouping and temperature classification

The apparatus grouping and temperature classification defined in IEC 60079-0 for the use of electrical apparatus in explosive gas atmospheres apply to flameproof enclosures. The subdivisions A, B and C for electrical apparatus of Group II also apply.

5 Flameproof joints

5.1 General requirements

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 Tables 1, 2, 3 and 4 form part of the specifications of this standard and constitute the minimum necessary conditions. Additional measures may be necessary in order to pass the non-transmission test of 15.2.

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.

A corrosion inhibiting grease 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 not be more than 0,008 mm thick.

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 1 and 2. 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

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

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 1 and 2.

Where the maximum constructional gap (i_c) is less than that required by Table 1 or 2, the value shall be stated in the certificate and the apparatus shall be marked according to 27.2 item i) of IEC 60079-0. In addition, this condition for safe use shall be specified in the manufacturer's instructions.

The surfaces of joints shall be such that their average roughness R_a (derived from ISO 468) does not exceed 6,3 μm .

For flanged joints, there shall be no intentional gap between the surfaces, except for quick-acting doors or covers.

For electrical apparatus 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.

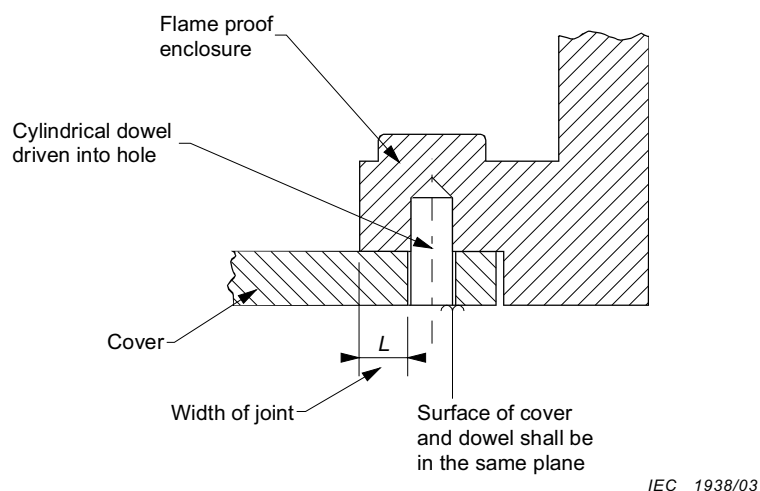


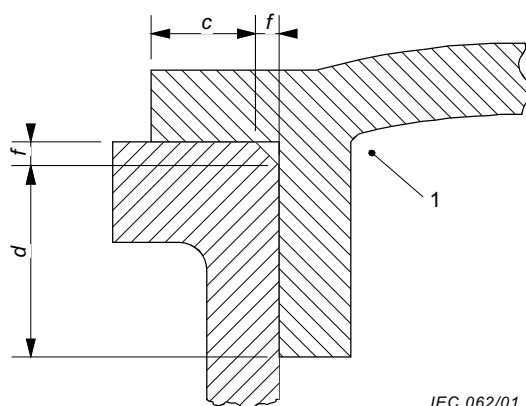
Figure 1 – Example of construction for indirect checking of a flanged Group I flameproof joint

5.2.3 Spigot joints

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

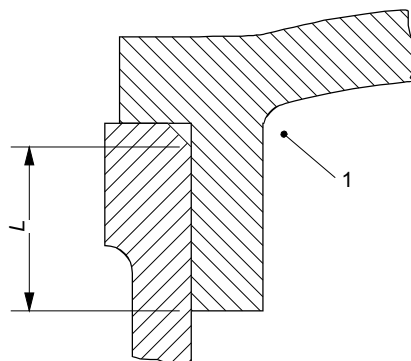
- The cylindrical part and the plane part (see Figure 2a). In this case, the gap shall nowhere exceed the maximum values given in Tables 1 and 2.
- The cylindrical part only (see Figure 2b). In this case, the plane part need not comply with the requirements of Tables 1 and 2.

NOTE For gaskets see also 5.4.



IEC 062/01

Figure 2a – Cylindrical part and plane part



IEC 063/01

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

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

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

The distance l is determined as follows.

5.2.4.1 Flanged joints with holes outside the enclosure (see Figures 3 and 5)

The distance l is measured between each hole and the inside of the enclosure.

5.2.4.2 Flanged joints with holes inside the enclosure (see Figure 4)

The distance l is measured between each hole and the outside of the enclosure.

5.2.4.3 Spigot joints where, to the edges of the holes, the joint consists of a cylindrical part and a plane part (see Figure 6)

The distance l is defined as follows:

- the sum of the width a of the cylindrical part and the width b of the plane part, if f is less than or equal to 1 mm and if the gap of the cylindrical part is less than or equal to 0,2 mm for electrical apparatus of Groups I and IIA, 0,15 mm for electrical apparatus of Group IIB, or 0,1 mm for electrical apparatus of Group IIC (reduced gap);
- the width b of the plane part alone, if either of the above-mentioned conditions is not met.

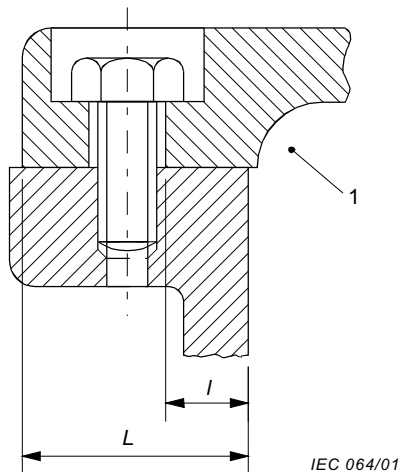


Figure 3

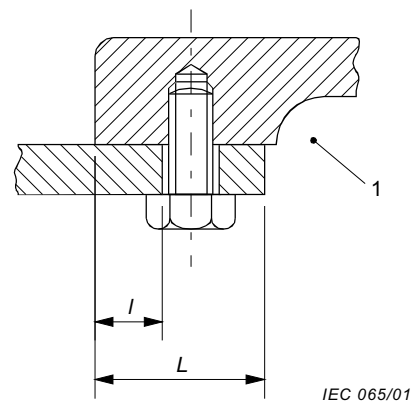


Figure 4

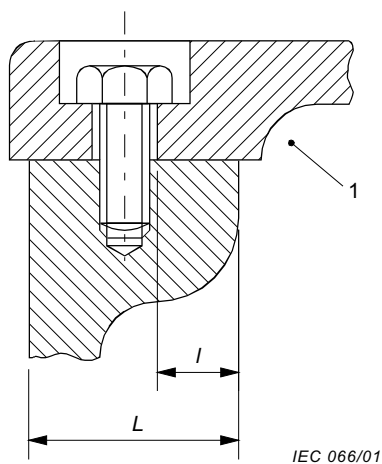


Figure 5

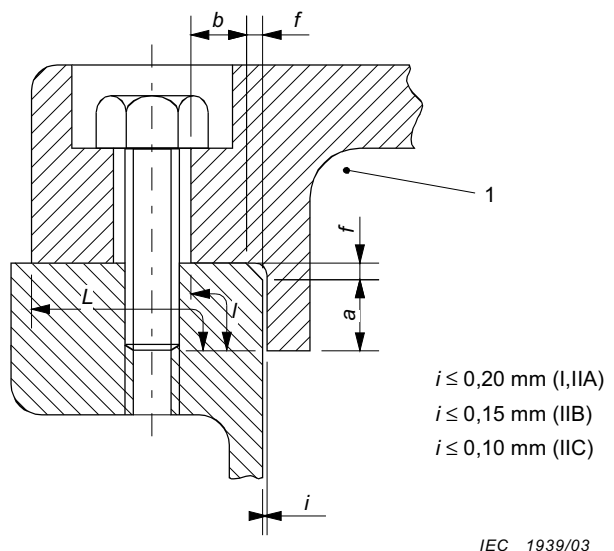


Figure 6

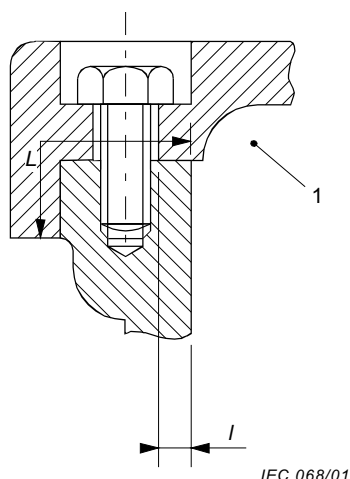


Figure 7

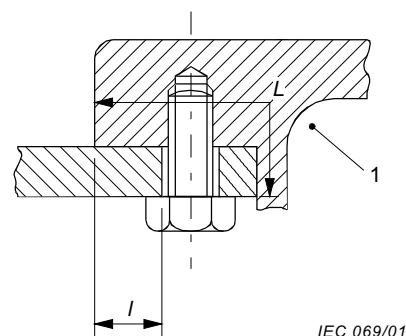


Figure 8

Key

1 Interior of enclosure

Figures 3, 4, 5 – Holes in surfaces of flanged joints

Figures 6, 7, 8 – Holes in surfaces of spigot joints

5.2.4.4 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 Tables 1 and 2. The gap shall be uniform through the conical part. For electrical apparatus of Group IIC, the cone angle shall not exceed 5° .

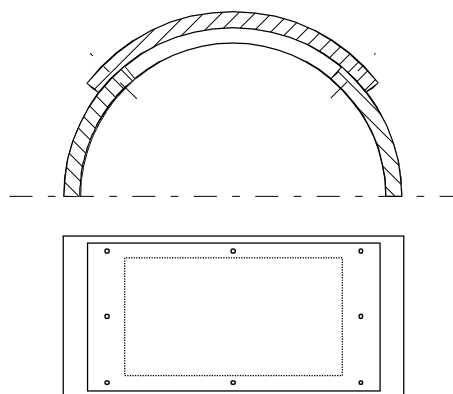
NOTE The cone angle is taken to be the angle between the vertical axis of the cone and the surface of the cone.

5.2.6 Joints with partial cylindrical surfaces (not permitted for Group IIC)

There shall be no intentional gap between the two parts (see Figure 9a).

The width of the joint shall comply with the requirements of Table 1.

The diameters of the cylindrical surfaces of the two parts forming the flameproof joint, and their tolerances, shall ensure compliance with the relevant requirements for the gap of a cylindrical joint as given in Table 1.



IEC 070/01

Figure 9a – Example of a joint with partial cylindrical surfaces

5.2.7 Additional requirements for joints of electrical apparatus of Group IIC

Flanged joints are not permitted for electrical apparatus of Group IIC intended for use in explosive gas atmospheres containing acetylene except if the gap is $\leq 0,04$ mm and $L \geq 9,5$ mm, and then only for enclosures having a volume not exceeding 500 cm^3 .

5.2.8 Serrated joints

Serrated joints need not comply with the requirements of Tables 1 and 2 but shall have

- a) at least five fully engaged serrations,
- b) a pitch greater than or equal to 1,25 mm, and
- c) an included angle of $60^\circ (\pm 5^\circ)$.

Serrated joints shall not be used for moving parts.

Serrated joints shall satisfy the test requirements of 15.2, with the test gap, i_E , between the mating serrations as specified in 15.2, based on the manufacturer's maximum constructional gap, i_C .

If the manufacturer's maximum constructional gap is different to that shown in Tables 1 or 2 for a flanged joint of the same length (determined by multiplying the pitch by the number of serrations), the maximum constructional gap shall be given in the certificate and the apparatus marked in accordance with 27.2 item i) of IEC 60079-0. In addition, this condition for safe use shall be specified in the manufacturer's instructions.

See Figure 9b.

Table 1 – Minimum width of joint and maximum gap for enclosures of Groups I, IIA and IIB

Type of joint		Minimum width of joint <i>L</i> mm	Maximum gap mm											
			For a volume cm ³ <i>V</i> ≤ 100			For a volume cm ³ 100 < <i>V</i> ≤ 500			For a volume cm ³ 500 < <i>V</i> ≤ 2 000			For a volume cm ³ <i>V</i> > 2 000		
			I	IIA	IIB	I	IIA	IIB	I	IIA	IIB	I	IIA	IIB
Flanged, cylindrical or spigot joints		6	0,30	0,30	0,20	—	—	—	—	—	—	—	—	—
		9,5	0,35	0,30	0,20	0,35	0,30	0,20	—	—	—	—	—	—
		12,5	0,40	0,30	0,20	0,40	0,30	0,20	0,40	0,30	0,20	0,40	0,20	0,15
		25	0,50	0,40	0,20	0,50	0,40	0,20	0,50	0,40	0,20	0,50	0,40	0,20
Cylindrical joints for shaft glands of rotating electrical machines with:	Sleeve bearings	6	0,30	0,30	0,20	—	—	—	—	—	—	—	—	—
		9,5	0,35	0,30	0,20	0,35	0,30	0,20	—	—	—	—	—	—
		12,5	0,40	0,35	0,25	0,40	0,30	0,20	0,40	0,30	0,20	0,40	0,20	—
		25	0,50	0,40	0,30	0,50	0,40	0,25	0,50	0,40	0,25	0,50	0,40	0,20
		40	0,60	0,50	0,40	0,60	0,50	0,30	0,60	0,50	0,30	0,60	0,50	0,25
	Rolling-element bearings	6	0,45	0,45	0,30	—	—	—	—	—	—	—	—	—
		9,5	0,50	0,45	0,35	0,50	0,40	0,25	—	—	—	—	—	—
		12,5	0,60	0,50	0,40	0,60	0,45	0,30	0,60	0,45	0,30	0,60	0,30	0,20
		25	0,75	0,60	0,45	0,75	0,60	0,40	0,75	0,60	0,40	0,75	0,60	0,30
		40	0,80	0,75	0,60	0,80	0,75	0,45	0,80	0,75	0,45	0,80	0,75	0,40
NOTE Constructional values rounded according to ISO 31-0 should be taken when determining the maximum gap.														

Table 2 – Minimum width of joint and maximum gap for Group IIC enclosures

Type of joint		Minimum width of joint L mm	Maximum gap mm			
			For a volume cm^3 $V \leq 100$	For a volume cm^3 $100 < V \leq 500$	For a volume cm^3 $500 < V \leq 2\,000$	For a volume cm^3 $V > 2\,000$
Flanged joints ^a		6	0,10	–	–	–
		9,5	0,10	0,10	–	–
		15,8	0,10	0,10	0,04	–
		25	0,10	0,10	0,04	0,04
Spigot joints (Figure 2a)	$c \geq 6 \text{ mm}$	12,5	0,15	0,15	0,15	–
	$d \geq 0,5 L$	25	0,18 ^b	0,18 ^b	0,18 ^b	0,18 ^b
	$L = c + d$	40	0,20 ^c	0,20 ^c	0,20 ^c	0,20 ^c
	$f \leq 1 \text{ mm}$					
Cylindrical joints Spigot joints (Figure 2b)		6	0,10	–	–	–
		9,5	0,10	0,10	–	–
		12,5	0,15	0,15	0,15	–
		25	0,15	0,15	0,15	0,15
Cylindrical joints for shaft glands of rotating electrical machines with rolling element bearings		40	0,20	0,20	0,20	0,20
		6	0,15	–	–	–
		9,5	0,15	0,15	–	–
		12,5	0,25	0,25	0,25	–
		25	0,25	0,25	0,25	0,25
		40	0,30	0,30	0,30	0,30
^a Flanged joints are permitted for explosive mixtures of acetylene and air only in accordance with 5.2.7. ^b Maximum gap of cylindrical part increased to 0,20 mm if $f < 0,5 \text{ mm}$. ^c Maximum gap of cylindrical part increased to 0,25 mm if $f < 0,5 \text{ mm}$.						
NOTE The constructional values rounded according to ISO 31-0 should be taken when determining the maximum gap.						

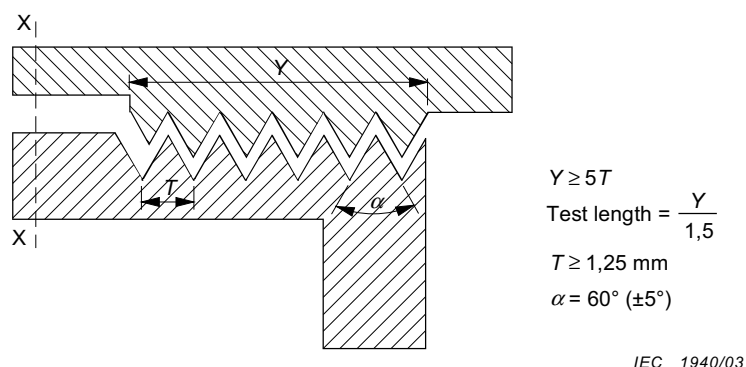


Figure 9b – Example of serrated joint

5.3 Threaded joints

Threaded joints shall comply with the requirements in Tables 3 or 4.

Table 3 – Cylindrical threaded joints

Pitch	≥0,7 mm ^a
Thread form and quality of fit	Medium or fine tolerance quality according to ISO 965-1 and ISO 965-3 ^b
Threads engaged	≥5
Depth of engagement	
Volume <100 cm ³	≥5 mm
Volume >100 cm ³	≥8 mm
^a Where the pitch exceeds 2 mm, special manufacturing precautions may be necessary (for example, more threads engaged) to ensure that the electrical apparatus can pass the test for non-transmission of an internal ignition which is prescribed in 15.2. ^b Cylindrical threaded joints which do not conform with ISO 965-3 in respect of thread form or quality of fit, are permitted if the test for non-transmission of an internal ignition, prescribed in 15.2, is passed, when the width of the threaded joint specified by the manufacturer is reduced by the amount specified in Table 6.	

Table 4 – Taper threaded joints

Pitch	≥0,9 mm
Threads provided on each part	≥5 ^b
Threads engaged	^c
^a Internal and external thread shall have the same nominal size, cone angle and thread form. ^b Threads shall conform to the NPT requirements of ANSI/ASME B1.20.1, and shall be made-up wrench tight. ^c Threads made in accordance with this table will provide greater than 3,5 effective threads engaged.	

5.4 Gaskets (including O-rings)

If a gasket of compressible or elastic material is used, for example, to protect against the ingress of moisture or dust or against leakage of a liquid, it shall be applied as a supplement, that is to say neither be taken into account in the determination of the width of the flameproof joint nor interrupt it.

The gasket shall then be mounted so that

- the permissible gap and width of flanged joints or the plane part of a spigot joint are maintained,
- the minimum width of joint of a cylindrical joint or the cylindrical part of a spigot joint are maintained before and after compression.

These requirements do not apply to cable glands (see 13.1) or to joints which contain a sealing gasket of metal or of a non-flammable compressible material with a metallic sheath. Such a sealing gasket contributes to the explosion protection, and in this case the gap between each surface of the plane part shall be measured after compression. The minimum width of the cylindrical part shall be maintained before and after compression.

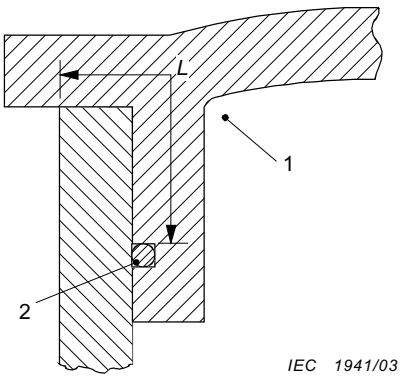


Figure 10

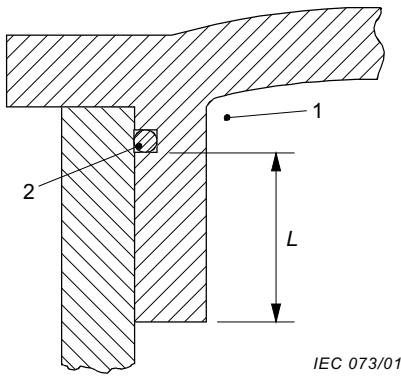


Figure 11

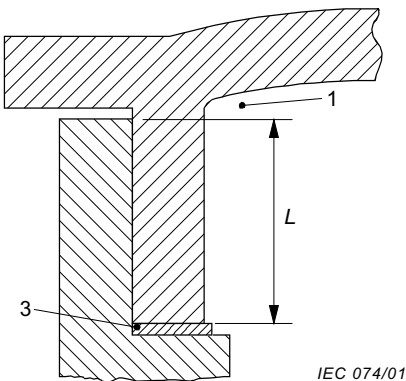


Figure 12

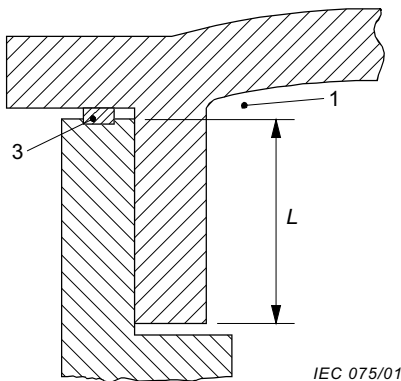


Figure 13

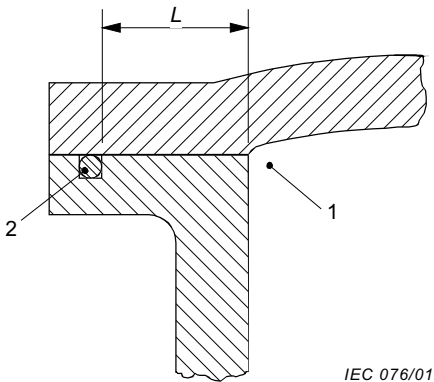


Figure 14

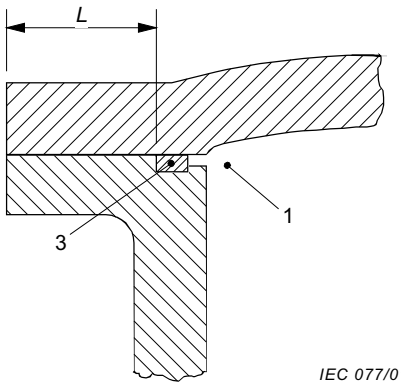


Figure 15

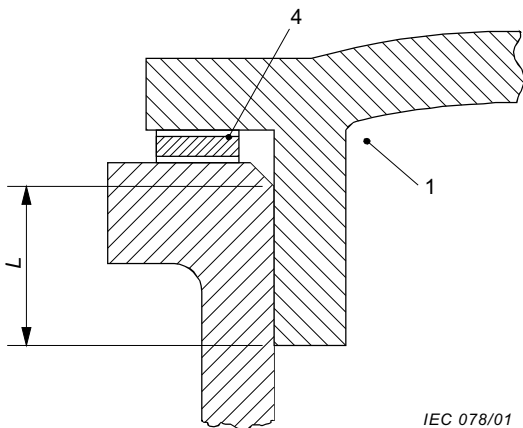


Figure 16

- Key**
- 1 Interior of enclosure
 - 2 O-ring
 - 3 Gasket
 - 4 Metallic or metal sheath gasket

Figures 10 to 16 – Illustration of the requirements concerning gaskets

5.5 Apparatus using capillaries

The capillaries shall either comply with the gap dimensions given in Table 1 or Table 2 for cylindrical joints using 0 as the diameter of the inner part, or when the capillaries do not conform to the gaps given in these tables, the apparatus shall be evaluated in accordance with the test for non-transmission of an internal ignition given in 15.2.

6 Cemented joints

6.1 General

Parts of a flameproof enclosure may be cemented either directly into the wall of the enclosure so as to form with the latter an inseparable assembly, or into a metallic frame such that the assembly can be replaced as a unit without damaging the cement.

If a joint which is cemented does not fulfil the requirements of Clause 5, in the absence of the cement it shall be subjected to 23.4.7.3 and 23.4.7.4 of IEC 60079-0.

6.2 Mechanical strength

Cemented joints are only permitted to ensure the sealing of the flameproof enclosure of which they form a part. Arrangements shall be made in the construction so that the mechanical strength of the assembly does not depend upon the adhesion of the cement alone. Cemented joints shall comply with a test based on Annex C with the relevant overpressure value given in 15.1.3.

6.3 Width of cemented joints

The shortest path through a cemented joint from the inside to the outside of a flameproof enclosure of volume V shall be

$$\begin{aligned} &\geq 3 \text{ mm if } V \leq 10 \text{ cm}^3 \\ &\geq 6 \text{ mm if } 10 \text{ cm}^3 < V \leq 100 \text{ cm}^3 \\ &\geq 10 \text{ mm if } V > 100 \text{ cm}^3 \end{aligned}$$

7 Operating rods

Where an operating rod passes through the wall of a flameproof enclosure, the following requirements shall be met.

7.1 If the diameter of the operating rod exceeds the minimum width of the joint specified in Tables 1 and 2, the width of the joint shall be at least equal to this diameter but without, however, having to exceed 25 mm.

7.2 If the diametrical clearance is liable to be enlarged as a result of wear in normal service, appropriate arrangements shall be made to facilitate a return to the original state, for example, by means of a replaceable bush. Alternatively, gap enlargement due to wear may be prevented by the use of bearings complying with Clause 8.

8 Supplementary requirements for shafts and bearings

8.1 Joints of shafts

Flameproof joints of shafts of rotating electrical machines shall be arranged so as not to be subject to wear in normal service.

The flameproof joint may be

- a cylindrical joint (see Figure 17), or
- a labyrinth joint (see Figure 18), or
- a joint with a floating gland (see Figure 19).

8.1.1 Cylindrical joints

Where a cylindrical joint contains grooves for the retention of grease, the region containing the grooves shall neither be taken into account when determining the width of a flameproof joint nor interrupt it (see Figure 17).

The minimum radial clearance k (see Figure 20) of shafts of rotating electrical machines shall not be less than 0,05 mm.

8.1.2 Labyrinth joints

Labyrinth joints which do not comply with the requirements of Tables 1 and 2 may nevertheless be considered as complying with the requirements of this standard if the tests specified in Clauses 14 through 16 are satisfied.

The minimum radial clearance k (see Figure 20) of shafts of rotating electrical machines shall not be less than 0,05 mm.

8.1.3 Joints with floating glands

The determination of the maximum degree of float of the gland shall take account of the clearance in the bearing and the permissible wear of the bearing as specified by the manufacturer. The gland may move freely radially with the shaft and axially on the shaft but it shall remain concentric with it. A device shall prevent rotation of the gland (see Figure 19).

Floating glands are not permitted for electrical apparatus of Group IIC.

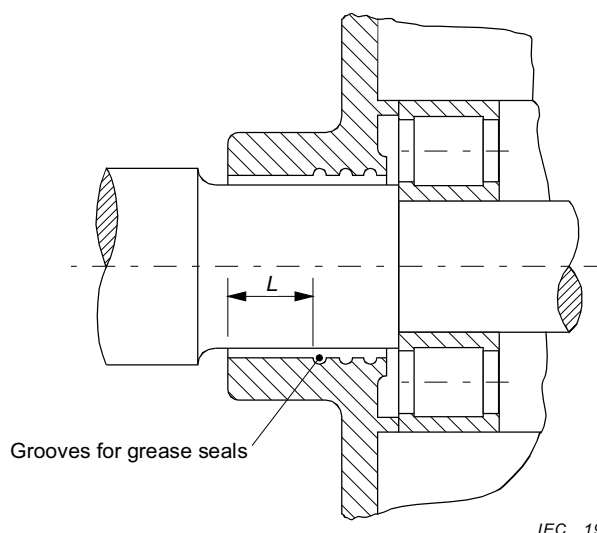


Figure 17 – Example of cylindrical joint for shaft of rotating electrical machine