IEC 60079-5

Edition 4.0 2015-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Explosive atmospheres –
Part 5: Equipment protection by powder filling "q"

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Atmosphères explosives –
Partie 5: Protection du matériel par remplissage pulvérulent "q"

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ICS 29.260.20

ISBN 978-2-8322-2249-2

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EXPLOSIVE ATMOSPHERES –

Part 5: Equipment protection by powder filling "q"

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International Standard IEC 60079-5 has been prepared by IEC technical committee 31: Equipment for explosive atmospheres.

This fourth edition cancels and replaces the third edition, published in 2007, and constitutes a technical revision.

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

NOTE The technical changes referred to include the significant technical changes in the revised IEC standard, but they do not form an exhaustive list of all modifications from the previous edition. More guidance may be found by referring to the redline version of the IEC standard, if available.

		Type		
Significant changes	**Clause/subclause**	**Minor and editorial changes**	**Extension**	**Major technical changes**
Specific references to IEC 60079-0 have been reworded so the references to IEC 60079-0 can be non-dated references	4.1.3 4.8 4.8.3	X		
The “housing” surrounding the powder filled equipment or Ex Component has been redefined as a “container” to avoid confusion with the “enclosure” requirements of IEC 60079-0	4.1	X		
A relaxation has been introduced to permit reduced distances through filling material for instances where there is no adjacent gap in the container	4.3.1		X	
A relaxation has been introduced to permit the use of creepage dimensions per IEC 60079-7 where CTI is better than 175	4.8.3		X	
An evaluation of joints employed when the reduced distances according to Table 1 are applied, has been added.	5.1.1		X	
Text for determination of maximum temperature clarified with respect to overloads and malfunctions	5.1.4	X		
A batch routine test has been introduced	5.2.1		X	

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

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FDIS	Report on voting
31/1156/FDIS	31/1171/RVD

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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.

The list of all parts of IEC 60079 series, 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 website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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

EXPLOSIVE ATMOSPHERES –

Part 5: Equipment protection by powder filling “q”

1 Scope

This part of IEC 60079 contains specific requirements for the construction, testing and marking of electrical equipment, parts of electrical equipment and Ex components in the type of protection powder filling “q”, intended for use in explosive gas atmospheres.

NOTE 1 Electrical equipment and Ex components protected by powder filling “q” can contain electronic circuits, transformers, protection fuses, relays, intrinsically safe electrical apparatus, associated electrical apparatus, switches, etc.

NOTE 2 Type of protection powder filling “q” provides Equipment Protection Level (EPL) Gb or Mb.

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

This standard applies to electrical equipment, parts of electrical equipment and Ex components with:

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– a rated supply current less than or equal to 16 A;
– a rated supply voltage less than or equal to 1 000 V;
– a rated power consumption less than or equal to 1 000 W.

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2 Normative references

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

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

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

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

IEC 60127 (all parts), *Miniature fuses*

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

IEC 61558-1, *Safety of power transformers, power supplies, reactors and similar products – Part 1: General requirements and tests*

IEC 61558-2-6, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers*

ISO 2859-1, *Sampling procedures for inspection by attributes – Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 3310-1, *Test sieves – Technical requirements and testing – Part 1: Test sieves of metal wire cloth*

ISO 3310-2, *Test sieves – Technical requirements and testing – Part 2: Test sieves of perforated metal plate*

ISO 2591-1, *Test sieving – Methods using test sieves of woven wire cloth and perforated metal plate*

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.

3.1
powder filling "q"
type of protection in which the parts capable of igniting an explosive gas atmosphere are fixed in position and completely surrounded by filling material to prevent the ignition of an external explosive gas atmosphere

Note 1 to entry: The type of protection may not prevent the surrounding explosive gas atmosphere from penetrating into the equipment and components and being ignited by the circuits. However, due to the small free volumes in the filling material and due to the quenching of a flame which may propagate through the paths in the filling material, an external explosion is prevented.

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3.2
filling material
solid quartz or solid glass particles

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3.3
container (for filling material)
housing immediately surrounding the electrical equipment protected by and containing the filling material

Note 1 to entry: The container may, in some cases, also be the external enclosure.

4 Constructional requirements

4.1 Containers

4.1.1 Closing and sealing

4.1.1.1 General

Containers of electrical equipment, parts of electrical equipment or Ex components protected by powder filling "q" shall be filled and sealed at the time of manufacture. The closing and sealing shall be the methods of 4.1.1.2 or 4.1.1.3.

4.1.1.2 Containers permanently sealed at the time of manufacture

The container shall be permanently sealed at the time of manufacture and shall not be capable of being opened without leaving visible evidence that the container has been opened. The container shall be marked in accordance with Clause 6, item a).

NOTE Suitable techniques that can provide visible evidence of containers being opened are, for example, welding, soldering, cemented joints, rivets, cementing of screws, or lead-seal safety-wiring of screws.

4.1.1.3 Containers intended to be opened for repair

Electrical equipment, parts of electrical equipment, or Ex components that are designed to be repaired shall incorporate sealing methods that are capable of being renewed without damage to the container when the equipment is repaired, re-filled, and re-sealed. The container shall be marked in accordance with Clause 6, item b).

4.1.2 Pressure test of container

The electrical equipment, parts of electrical equipment or Ex components protected by powder filling “q” shall meet the pressure test requirements specified in 5.1.1.

4.1.3 Degree of protection of the container

The container of the electrical equipment, parts of electrical equipment, or Ex components protected by powder filling “q”, in their normal service condition, i.e. with all openings closed as in normal use, shall comply at least with the degree of protection IP54 as defined in IEC 60529. If the degree of protection is IP55 or higher, and the container is not hermetically sealed, the container shall be provided with a breathing device. The container with the breathing device in place shall comply at least with the degree of protection IP54 according to IEC 60529. The test shall be conducted on an empty container without the powder filling installed. At the end of any water ingress tests, no water shall be visible inside the container.

NOTE 1 As the container may need to be destroyed in order to determine the entrance of dust or water, two separate test samples could be required for the two ingress tests.

NOTE 2 When the container is also the external enclosure, the tests of enclosures requirements of IEC 60079-0 apply.

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The ingress protection of containers or parts of electrical equipment protected by powder filling “q”, intended for use only in clean, dry rooms, may be reduced to degree of protection IP43. The certificate number of this equipment shall include the "X" suffix in accordance with the marking requirements of IEC 60079-0, and the Specific Conditions of Use listed on the certificate shall detail the restrictions of use.

When Ex components protected by powder filling “q” are intended to be mounted inside another enclosure complying with IEC 60079-0, this outer enclosure shall have a degree of protection of at least IP54. The IP rating of the inner container does not need to be specified provided that the Ex component is mounted in a position where it is unlikely to be contaminated by any small amounts of water that may enter the outer enclosure.

NOTE 3 The impact and drop tests of enclosures from IEC 60079-0 do not generally apply to Ex Components intended to be mounted inside another enclosure complying with IEC 60079-0, as the external enclosure provides the protection against impact and drop.

The maximum gap of a container protected by powder filling “q” shall be at least 0,1 mm smaller than the specified smallest dimension of the filling material.

NOTE 4 The restriction on the size of the gap is intended to reduce the escape of filling material.

4.1.4 Filling procedure

Filling shall be carried out so as not to leave any void within the filling material (for example by shaking down). The free space within electrical equipment, parts of electrical equipment or Ex components protected by powder filling “q” shall be effectively filled with filling material (see also 4.3.2).

4.1.5 Containers that are not external enclosures

The container of type of protection “q” equipment or Ex Component that is installed or intended to be installed internal to another enclosure is considered the same as that of an Ex Component.

4.2 Filling material

4.2.1 Material specification

The material shall be quartz or solid glass particles.

The material specification shall state that, determined in accordance with the ISO 2591-1 procedure for dry materials, the size of particles are within the following sieve sizes:

– 1 mm nominal aperture sieve in accordance with ISO 3310-1 or ISO 3310-2

– 500 µm nominal aperture sieve in accordance with ISO 3310-1.

4.2.2 Documentation

The documents prepared by the manufacturer in accordance with IEC 60079-0 shall include the specification of the particle material, the size range of the particles, as well as the filling process and the measures taken to ensure proper filling.

NOTE It is not a requirement of this standard that conformity to the specification of the particle material and size range of the particles needs to be verified.

4.2.3 Testing

The filling material shall be subjected to the dielectric strength test specified in 5.1.3.

4.3 Distances

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4.3.1 Distances through filling material

Except where specified otherwise in this standard, the minimum distance through the filling material between electrically conducting parts of the equipment and the container shall comply with Table 1 and Figure 1. This does not apply to conductors used for field wiring connections which penetrate the wall of the container.

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Table 1 – Distances through the filling material

Voltage[a] a.c. r.m.s. or d.c. V	Minimum distance mm	Reduced distance [b] mm
$U \leq 80$	5	1,5
$U \leq 100$	5	2
$U \leq 125$	5	2
$U \leq 160$	5	2
$U \leq 200$	5	3
$U \leq 250$	5	3
$U \leq 400$	6,3	3
$U \leq 500$	8	3
$U \leq 800$	10	5
$U \leq 1\ 000$	14	5
$U \leq 1\ 600$	16	10
$U \leq 2\ 500$	25	10
$U \leq 3\ 200$	32	10
$U \leq 4\ 000$	40	14
$U \leq 5\ 000$	50	14
$U \leq 6\ 300$	63	25
$U \leq 8\ 000$	80	25
$U \leq 10\ 000$	100	40

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[a] When determining the required values for creepage and distance, the working voltage may be higher than the voltage in the table by a factor of 1,1 (see Note).

NOTE The factor of 1,1 recognizes that at many places in a circuit, the working voltage equals the rated voltage and that there are a number of rated voltages in common use that can be accommodated by the 1,1 factor.

[b] To ensure that there is a sufficient path length through the filling material to provide quenching of a flame from the inside to the outside of the container, the reduced distances shown are permitted only when there is no adjacent gap in the container that could permit a flame to exit. See Figure 1.

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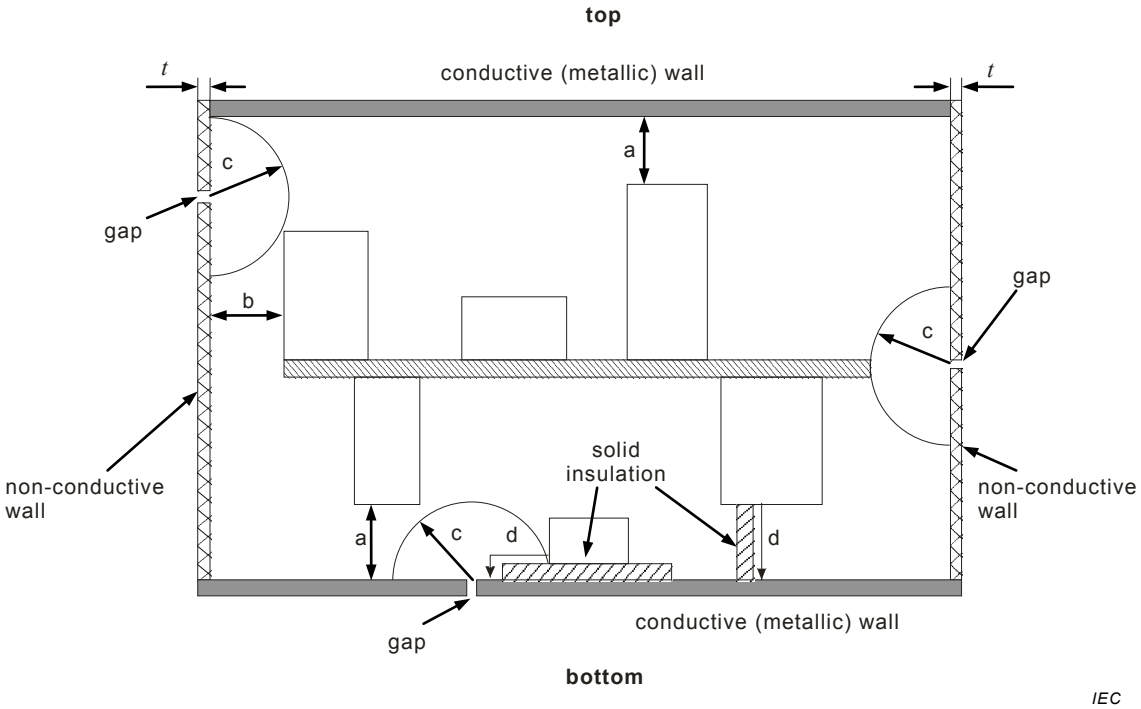

Key

[a] distance to conductive wall according Table 1, reduced distance

[b] distance to non conductive wall with thickness t: $b \geq$ (distance according Table 1) – t

[c] distance to gap, minimum radius according Table 1, no reduced distance

[d] creepage distance according Table 2

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Figure 1 – Distances through filling material

Malfunction conditions according to 4.8 shall be considered when determining the working voltage.

NOTE While this standard is applicable to equipment with a rated supply voltage not exceeding 1 000 V, Table 1 takes into account working voltages greater than 1 000 V which can be developed or generated within the equipment or Ex Component. A typical example is a fluorescent luminaire ballast with a rated voltage of 240 V, but with an arc initiation voltage of approximately 2 000 V.

4.3.2 Distances surrounding free space

If electrical equipment contains components which have an enclosed free space not filled with the filling material (e.g. a relay), the following requirements apply:

– if the enclosed free space of the component is less than 3 cm^3, the minimum distance through the filling material between the component wall and the inner surface of the container shall comply with Table 1. The reduced distances are not permitted;

– if the enclosed free space of the component is between 3 cm^3 and 30 cm^3, the minimum distance through the filling material between the component wall and the inner surface of the container shall comply with Table 1 but with a minimum of 15 mm;

– the component shall be fixed, so that movement nearer to the wall of the container is not possible;

– the free volume shall not exceed 30 cm^3;

– the enclosure of the component shall resist the thermal and mechanical stresses to which it will be subjected even under malfunction conditions according to 4.8. There shall be no damage or distortion which could reduce the protection provided by the filling material.