BS EN 60079-31:2014

BSI Standards Publication

Explosive atmospheres

Part 31: Equipment dust ignition protection by enclosure “t”

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National foreword

This British Standard is the UK implementation of EN 60079-31:2014. It is identical to IEC 60079-31:2013. It supersedes BS EN 60079-31:2009 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EXL/31, Equipment for explosive atmospheres.

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

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Published by BSI Standards Limited 2014

ISBN 978 0 580 78740 9
ICS 29.260.20

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 July 2014.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60079-31

July 2014

ICS 29.260.20

Supersedes EN 60079-31:2009

English Version

Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosure "t" (IEC 60079-31:2013)

Atmosphères explosives - Partie 31: Protection contre l'inflammation de poussières par enveloppe "t" relative au matériel
(CEI 60079-31:2013)

Explosionsgefährdete Bereiche - Teil 31: Geräte-Staubexplosionsschutz durch Gehäuse "t"
(IEC 60079-31:2013)

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Foreword

The text of document 31/1079/FDIS, future edition 2 of IEC 60079-31, prepared by IEC/TC 31 "Equipment for explosive atmospheres" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60079-31:2014.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-01-01
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2017-01-01

This document supersedes EN 60079-31:2009.

The State of the Art is included in Annex ZY “Significant changes between this European Standard and EN 60079-31:2009”.

For the significant changes with respect to EN 60079-31:2009, see Annex ZY.

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

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive.

For the relationship with EU Directive see informative Annex ZZ, which is an integral part of this document.

Endorsement notice

The text of the International Standard IEC 60079-31:2013 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu

Publication	Year	Title	EN/HD	Year
IEC 60079-0	-	Explosive atmospheres - Part 0: Equipment - General requirements	EN 60079-0	-
IEC 60127	Series	Miniature fuses	EN 60127	Series
IEC 60691	-	Thermal-links - Requirements and application guide	EN 60691	-
ISO 965-1	-	ISO general-purpose metric screw threads - Tolerances - Part 1: Principles and basic data	-	-

Annex ZZ
(informative)

Coverage of Essential Requirements of EU Directives

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and within its scope the standard covers only the following essential requirements out of those given in Annex II of the EU Directive 94/9/EC:

- ER 1.0.1, ER 1.0.2 (partly), ER 1.0.4, ER 1.0.5 (partly)
- ER 1.1
- ER 1.2.1 (partly), ER 1.2.2 (partly)
- ER 1.2.4
- ER 1.2.7
- ER 1.2.8 (partly)
- ER 1.3.1
- ER 1.6.4
- ER 2.1
- ER 2.2
- ER 2.3

Compliance with this standard provides one means of conformity with the specified essential requirements of the Directive concerned.

WARNING: Other requirements and other EU Directives may be applicable to the products falling within the scope of this standard.

Annex ZY
(informative)

Significant changes between this European Standard and EN 60079-31:2009

This European Standard supersedes EN 60079-31:2009.

The significant changes with respect to EN 60079-31:2009 are as listed below.

		Type		
Changes	**Clause**	**Minor and editorial changes**	**Extension**	**Major technical changes**
Document has been restructured from the first edition	Numerous	X		
The marked maximum surface temperature shall be measured on the external surfaces of the enclosure and the surfaces of the internal components for equipment with types of protection “ta”	4.3.2			C1
Additional protection for arcing and sparking parts for “ta”	4.3.6			C2
Limiting the internal pressure test to enclosures where the seal is not physically constrained from moving.	4.4.2		X	
Requirements for tapered threaded joints without an additional seal or gasket added.	5.1.2		X	
Requirements for cable gland aligned for all levels and Groups the only difference is now the required IP protection	5.2	X		
Requirements for plain entries added	5.3.1		X	
5 threads for parallel threads only required when no seal is used	5.3.2		X	
Test for internal enclosure for level “ta” added.	6.1.1.2			C 3
Eliminating of the “fault” table and reduction of the dust layer depth for the thermal test for type of protection “ta”.	6.1.2		X	

NOTE The technical changes referred to include the significance of technical changes in the revised EN standard, but they do not form an exhaustive list of all modifications from the previous version. More guidance may 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.

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 – A requirement was added for "ta" to require the temperature marking to be based on the highest of either the temperature produced by the internal components or the external surface temperature.

C2 – Requirements were added for "ta" equipment that contains a normally arcing part to require a supplementary internal enclosure around the arcing part.

C3 – Requires an impact test on the supplementary enclosure for "ta" equipment.

CONTENTS

EXPLOSIVE ATMOSPHERES –

Part 31: Equipment dust ignition protection by enclosure "t"

1 Scope

This part of IEC 60079 is applicable to electrical equipment protected by enclosure and surface temperature limitation for use in explosive dust atmospheres. It specifies requirements for design, construction and testing of electrical equipment and Ex Components.

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 does not apply to dusts of explosives, which do not require atmospheric oxygen for combustion, or to pyrophoric substances.

This standard does not apply to electrical equipment or Ex Components intended for use in underground parts of mines as well as those parts of surface installations of such mines endangered by firedamp and/or combustible dust.

This standard does not take account of any risk due to an emission of flammable or toxic gas from the dust.

Consideration of additional protective measures is required where the application of electrical equipment is in atmospheres, which can contain combustible dust as well as explosive gas, whether simultaneously or separately.

Where the electrical equipment has to meet other environmental conditions, for example, protection against ingress of water and resistance to corrosion, additional measures can be necessary. The measures used should not adversely affect the integrity of the enclosure.

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 60127 (all parts), *Miniature fuses*

IEC 60691, *Thermal-links – Requirements and application guide*

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

3 Terms and definitions

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

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

3.1
dust ignition protection by enclosure “t”
type of protection for explosive dust atmospheres where electrical equipment is provided with an enclosure providing dust ingress protection and a means to limit surface temperatures

3.2
joint
place where the corresponding surfaces of two parts of an enclosure, or the conjunction of enclosures, come together

3.3
gasket
compressible element provided in a joint to provide a degree of protection against the ingress of solid foreign objects and /or against ingress water/dust

4 General

4.1 Levels of protection

Type of protection “t” is divided into three Levels of Protection based on the risk of the electrical equipment becoming an ignition source in an explosive dust atmosphere. Electrical equipment with dust ignition protection by enclosure “t” shall be either:

- Level of Protection “ta” (EPL “Da”), or
- Level of Protection “tb” (EPL “Db”), or
- Level of Protection “tc” (EPL “Dc”).

The construction and marking requirements apply to all electrical equipment, and in addition, the requirements for "ta" as given in 4.3 and the requirements for "tb" and "tc" as given in 4.4.

Failure modes as defined in the industrial standard for particular components shall be taken into account when considering applicable fault conditions.

4.2 Equipment groups and ingress protection

The relationship between the level of protection, the group, and ingress protection required is shown in Table 1.

Table 1 – Level of Protection, equipment group and ingress protection (IP) relationship

Level of Protection	Group IIIC	Group IIIB	Group IIIA
“ta”	IP6X	IP6X	IP6X
“tb”	IP6X	IP6X	IP5X
“tc”	IP6X	IP5X	IP5X
Ingress protection shall be determined in accordance with degree of protection (IP) of enclosures as specified in IEC 60079-0 for level of protection “tb” and “tc”. For Level of Protection “ta” the level of depression shall be increased to at least 4 KPa for a period of least 8 h. Any grease in the joints shall be removed before the IP test is performed. When IP5X is required, all enclosures including rotating machines, shall satisfy the test and acceptance requirements of IP5X, as specified in IEC 60529.			

4.3 Requirements for electrical equipment with level of protection “ta”

4.3.1 Fault current

For Level of Protection “ta”, the electrical equipment shall be rated for connection to a circuit having a prospective short circuit current of not greater than 10 kA. Where the prospective short circuit current withstand is less than 10 kA, it shall be marked according to Clause 7.

4.3.2 Maximum surface temperature

The requirements for maximum surface temperature for “ta” electrical equipment modify and supplement the requirements of IEC 60079-0.

The marked maximum surface temperature shall be measured on the external surfaces of the enclosure and the surfaces of the internal components for electrical equipment with types of protection “ta” in accordance with 6.1.2. The highest of the measured temperatures shall be the basis for the maximum surface temperature marking.

4.3.3 Overpressure

A positive internal pressure of 4 kPa shall be applied to the enclosure in accordance with 6.1.1.3 prior to the dust exclusion test.

4.3.4 Dust exclusion

Dust exclusion by enclosure shall be carried out in accordance with 6.1.1.

4.3.5 Protective devices

4.3.5.1 General

If the electrical equipment is capable of exceeding the maximum surface temperature as a result of the temperature test of 6.1.2, a protective device is required. The protective device may be directly integrated into the electrical equipment or be external to the electrical equipment.

Where the external protective device is not provided by the manufacturer as part of the electrical equipment, the marking shall include the symbol “X” in accordance with IEC 60079-0, and the specific Conditions of Use shall detail the required ratings and characteristics of the protective device. The protective device shall be capable of interrupting the maximum current of the circuit in which it is installed. If the electrical equipment contains a cell or battery and a control device is provided to prevent overheating of the cell or battery, the control device can also be considered as a protective device, provided it also protects the complete electrical equipment from exceeding the maximum surface temperature.

4.3.5.2 Thermal protective devices

The electrical equipment shall be protected by one or more integral thermal protective devices. Thermal protective devices shall not be of a self-resettable type and shall be duplicated unless conforming to IEC 60127 series or IEC 60691, in which case only one device is necessary.

Alternatively, if it can be demonstrated that an overcurrent protective device can be used to provide thermal protection, such a device may be used. The overcurrent protective device used in this way shall conform to IEC 60127 series and shall be rated at not more than 170 % of the maximum rated current of the electrical equipment. When an overcurrent protective device is not also used as a thermal protective device, it is permissible for the overcurrent protective device to be located outside the enclosure of the electrical equipment. In this case, the marking shall include the symbol "X" in accordance with IEC 60079-0 and the Specific Conditions of Use shall detail the required overcurrent protective device.

The response time of the thermal protective devices should be taken into account and be adequate for the necessary overtemperature protection.

NOTE When no such information exists, a common practice is to use 1.7 × rated current

4.3.6 Protection for arcing and sparking parts

Where normally arcing and sparking parts are incorporated, these parts shall have a supplementary enclosure inside the main enclosure. This supplementary enclosure shall meet the requirements for a “tc” enclosure with the following exceptions and modifications:

- The tests for thermal endurance to heat and cold and resistance to light, specified in 6.1.1.1 are not applicable,
- A COT of at least equal to the lower specified ambient temperature and at least 20 K greater than the maximum service temperature applies for non-metallic materials,
- The internal enclosure is not considered to have external surfaces and the resistance to ultraviolet light and electrostatic requirements are not applicable,
- The requirements for threaded entries, hinges, and requirements for threaded fasteners are not applicable,
- Resistance to impact test is performed in accordance with 6.1.1.2 with no hot and cold impact testing required,
- Pressure test is not applied,
- IP6X is required.

4.4 Requirements for electrical equipment with Level of Protection “tb” and “tc”

4.4.1 Maximum surface temperature

The marked maximum surface temperature shall be measured on the external surfaces of the enclosure for electrical equipment with types of protection “tb” and “tc" in accordance with 6.1.2 with no dust layer on the external surfaces under normal operating conditions.

4.4.2 Over pressure

A positive internal pressure of 2 kPa shall be applied to the enclosure in accordance with 6.1.1.3 prior to the dust exclusion test, except where the design of the electrical equipment is such that gaskets or seals are physically constrained from moving e.g. an “O” ring in a groove.

4.4.3 Dust exclusion

Dust exclusion by enclosure shall be carried out in accordance with 6.1.1.

5 Construction

5.1 Joints

5.1.1 General

All joints in the structure of the enclosure, whether permanently closed or designed to be opened from time to time, shall fit closely together within the tolerances specified in the documentation. They shall be effectively sealed against the ingress of dust and shall comply with the following particular requirements and be subjected to the test of 6.1.1.

The use of grease alone to maintain the integrity of the seal is not considered to satisfy this requirement.

5.1.2 Threaded joints

- The number of engaged threads for all threaded joints, employing parallel threads without an additional seal or gasket shall be not less than five threads and with a tolerance quality of medium or fine according to ISO 965-1. Tapered threaded joints without an additional seal or gasket shall engage no less than 3½ threads.
- Hinges shall not be used as a means of maintaining a seal unless:
  - correct compression of the gasket is achieved without causing undue movement, stress or distortion to the gasket; and
  - they are manufactured from materials that would not affect the correct function of the sealing means.

Where necessary, a means shall be provided to facilitate correct alignment of mating parts.

5.1.3 Gaskets and seals

Gaskets under compression in joints may be used to ensure the effectiveness of the enclosure sealing.

All gaskets and seals shall be of one-piece continuous construction, i.e. with an uninterrupted periphery.

One-piece construction also includes gaskets and seals that have been permanently joined to form an uninterrupted periphery while maintaining the mechanical properties of the gasket or seal material.

Unless all gaskets are secured to one face of the mating surface, either by adhesive or mechanically secured, the design of the enclosure shall be such that gaskets are correctly positioned. Except for a slight amount of lubricant necessary for assembly or an adhesive material on one side of the mating surfaces, joints using gaskets shall not be supplemented by the application of a sealant material.

A flexible seal, e.g. a bellows, shall be such that it is not over-stressed at any point and shall be protected from external mechanical damage and secured at each end by mechanical means.

These requirements do not apply to internal seals of cable glands.

5.1.4 Cemented joints

Cemented joints shall not be used on mating parts which need to be removed to gain access to field wiring connections or in-service adjusting facilities.

5.1.5 Operating rods, spindles and shafts

Openings in enclosures for rods, spindles or shafts shall have means to inhibit the ingress of dust, other than only grease or compound, both when the spindles, rods or shafts are in motion and when they are at rest.

5.1.6 Windows

5.1.6.1 Windows employing a cemented joint

A window design employing a cemented joint shall be such that it is cemented either directly into the wall of the enclosure so as to form with the latter an inseparable assembly, or into a frame such that the assembly can be replaced as a unit.

5.1.6.2 Windows employing a gasket joint

A window design employing a gasket for dust exclusion shall be such that it is mounted directly in the wall or cover of the enclosure. No separate detachable frame is required.

5.2 Cable glands

Cable glands, whether integral or separate, shall meet the requirements of IEC 60079-0, and the joint requirements of 5.1. In addition, cable glands shall meet the requirements of Table1.

Where cable glands are separate:

– threaded cable glands may be evaluated as Ex Equipment cable gland,

– other cable glands may be evaluated only as an Ex Component,

– cable glands with other thread forms to those specified here may be evaluated only with the electrical equipment or as an Ex component.

5.3 Entries

5.3.1 Plain entries

The clearance holes for plain entries shall have a diameter not more than 0,7 mm greater than the nominal diameter of the entry thread gland or fitting. The inside of the enclosure shall be provided with sufficient room to attach a locknut to the gland or fitting.

5.3.2 Threaded entries

Threaded entries are considered to meet the requirements for “ta”, “tb” and “tc” electrical equipment if they are:

- Tapered threads with not less than 3 threads,
- Parallel threads with not less than five threads, with a tolerance class of 6H or better according to ISO 965-1,
- Parallel threads with less than five threads with a tolerance class of 6H or better according to ISO 965-1 and are provided with an additional seal or gasket. If the additional seal is not an integral part of the electrical equipment, the marking shall include the symbol "X" in accordance with IEC 60079-0 and the Specific Conditions of Use that detail the required use of a seal or gasket. An advisory marking of the requirement for a seal or gasket may appear on the electrical equipment as an alternative to the requirement for the “X” marking.

6 Verification and tests

6.1 Type tests

6.1.1 Type tests for dust exclusion by enclosures

6.1.1.1 General

Samples of the electrical equipment shall be subjected to the thermal endurance to heat, thermal endurance to cold and impact tests specified in IEC 60079-0, and the drop test if applicable. If there is a supplementary enclosure, there shall be no visual damage to the supplementary enclosure caused by the impact testing of the main enclosure.

The supplementary enclosure may be removed during the thermal endurance to heat and thermal endurance to cold tests.

For level of protection "tc", the test of enclosures requirements of IEC 60079-0 are modified for the thermal endurance to heat preconditioning test to replace the 20 K above the service temperature (Ts+20 K) with 10 K above the service temperature (Ts+10K).

After conducting the tests of enclosures in accordance with IEC 60079-0, one of the samples which has been subjected to the tests of enclosures shall then be subjected to the pressure test of 6.1.1.3. followed by the IP test of 6.1.1.4.

6.1.1.2 Impact test for supplementary enclosures

The impact test for supplementary enclosures shall be performed in accordance with the resistance to impact test of IEC 60079-0 using the 1 kg mass dropped from a height of 0,2 m. There shall be no damage which invalidates the type of protection.

6.1.1.3 Pressure test

A positive internal pressure of at least:

- 4 ± 0,4 kPa for level of protection “ta” electrical equipment, or
- 2 ± 0,2 kPa for level of protection “tb” and “tc” electrical equipment,

shall be applied to the electrical equipment for 60^{10}_{-0} s. Any breathing or draining device may be sealed for this test if the pressure cannot be maintained. Any seals of the breathing or draining device shall be removed and the sample shall be subjected to the IP test in the condition it is in after the completion of this test. This test is not required for cable glands evaluated as Ex Equipment cable gland.

If the design of the electrical equipment is such that any gaskets or seals are physically constrained from moving, e.g. an “O” ring in a groove, this test is not required to be conducted for “tb” and “tc” electrical equipment.

6.1.1.4 IP test

The samples shall be IP tested for the different level of protection as given in Table 1. Any grease in the joints shall be removed before the IP test is performed.

6.1.2 Thermal tests

For “tb” and “tc” electrical equipment the test shall be carried out as described in IEC 60079-0.

For “ta” electrical equipment, the maximum surface temperature test of IEC 60079-0 is conducted with the electrical equipment surrounded by at least a 200 mm layer of dust on all sides. The final temperature shall have been considered to have been reached when the rate of rise of temperature does not exceed 1 K/24h. This test is carried out as described in IEC 60079-0 and with one additional fault applied to the electrical equipment.

NOTE See IEC 60079-0 for the specification of the test dust

6.2 Routine tests

There are no additional routine tests required for levels of protection “ta”, “tb”, or “tc”.

7 Marking

These requirements supplement the requirements of IEC 60079-0, which are applicable to Levels of Protection "ta", “tb” and “tc”. The symbol for the Type of Protection used shall be “ta”, “tb”, or “tc”, as applicable.

Where the electrical equipment is only suitable for a maximum rated prospective short circuit current for “ta” electrical equipment at the supply connection point to the electrical equipment of less than 10 kA, the prospective short circuit current shall be marked.

Bibliography

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

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