



BSI Standards Publication

Explosive atmospheres

Part 7: Equipment protection by increased safety "e"

National foreword

This British Standard is the UK implementation of EN 60079-7:2015+A11:2024. It is identical to IEC 60079-7:2015, incorporating amendment 1:2017. It supersedes BS EN IEC 60079-7:2015+A1:2018, which is withdrawn. It partially supersedes BS EN 60079-15:2010, specifically the requirements for Type of Protection “nA”.

The significance of the changes between this standard and BS EN 60079-7:2007 (for “ec”), and between this standard and BS EN 60079-15:2010 (for “nA”) are listed in a table in the IEC foreword.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to IEC text carry the number of the IEC amendment. For example, text altered by IEC amendment A1 is indicated by A1 A1.

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 committee manager.

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For the Great Britain market (England, Scotland and Wales), if UK Government has designated this publication for conformity with UKCA marking (or similar) legislation, it may contain an additional National Annex. Where such a National Annex exists, it shows the correlation between this publication and the relevant UK legislation. If there is no National Annex of this kind, the relevant Annex ZA or ZZ in the body of the European text will indicate the relationship to UK regulation applicable in Great Britain. References to EU legislation may need to be read in accordance with the UK designation and the applicable UK law. Further information on designated standards can be found at www.bsigroup.com/standardsandregulation.

For the Northern Ireland market, UK law will continue to implement relevant EU law subject to periodic confirmation. Therefore Annex ZA/ZZ in the European text, and references to EU legislation, are still valid for this market.

UK Government is responsible for legislation. For information on legislation and policies relating to that legislation, consult the relevant pages of www.gov.uk.

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Published by BSI Standards Limited 2024

ISBN 978 0 539 28729 5

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 December 2015.

Amendments/corrigenda issued since publication

Date	Text affected
31 January 2017	Implementation of IEC Interpretation sheet Sep-tember 2016 in National Annex NA
30 June 2018	Implementation of IEC amendment 1:2017 with CENELEC endorsement A1:2018
31 July 2019	Table 5 corrected
31 January 2024	Implementation of CENELEC amendment A11:2024

National Annex NA
(Informative)

IEC 60079-7
Edition 5.0 2015-06

EXPLOSIVE ATMOSPHERES –

Part 7: Equipment protection by increased safety 'e'

INTERPRETATION SHEET 1

This interpretation sheet has been prepared by IEC technical committee 31: Equipment for explosive atmospheres.

The text of this interpretation sheet is based on the following documents:

ISH	Report on voting
31/1258/ISH	31/1272/RVD

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

IEC 60079-7:2015 Edition 5.0, *Explosive atmospheres – Part 7: Equipment protection by increased safety “e”*

Question:

Do the requirements given in 5.2.3 prohibit the use of a terminal box opened to the interior of a motor rated 1 kV or greater, provided the interior of the machine has an ingress protection of IP54 or greater?

IEC 60079-7:2015 Edition 5.0

5.2.3 Degrees of protection provided by electrical machines, Level of Protection “ec”

The requirements of 4.10 apply, except that terminal boxes attached to electrical machines operating at voltages up to 1 kV, may be opened to the interior of the machine, only when the degree of protection of the electrical machine is at least IP44. Covers and entries of the terminal box shall provide at least degree of protection IP54.

Answer:

No. As long as the interior of the machine has an ingress protection of IP54 or greater, determined in accordance with IEC 60079-0, there is no limitation to less than 1 kV. If the interior of the machine has an ingress rating of IP44 or lower, the use of a terminal box open to the interior of a motor rated 1 kV or greater is not permitted.

NOTE Many manufacturers opt to declare IP44 for the machine for certification purposes, whilst claiming a rating of IP54 or higher, by assessment, for contractual purposes in order to avoid the difficult testing required for certification of the IP of larger machines. As such, this additional IP rating need only comply with IEC 60529 or IEC 60034-5 as applicable, and not with any of the testing detailed in IEC 60079-0.

English Version

Explosive atmospheres — Part 7: Equipment protection by increased safety "e" (IEC 60079-7:2015)

Atmosphères explosives — Partie 7:
Protection de l'équipement par sécurité
augmentée "e" (IEC 60079-7:2015)

Explosionsfähige Atmosphäre — Teil 7: Geräteschutz
durch erhöhte Sicherheit "e" (IEC 60079-7:2015)

This European Standard was approved by CENELEC on 2015-07-31. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

European foreword

The text of document 31/1182/FDIS, future edition 5 of IEC 60079-7, prepared by IEC/TC 31 "Equipment for explosive atmospheres" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60079-7:2015.

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) 2016-06-11
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2018-07-31

This document supersedes EN 60079-7:2007.

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Endorsement notice

The text of the International Standard IEC 60079-7:2015 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC/TS 60034-17	NOTE	Harmonized as CLC/TS 60034-17.
IEC 60034-18-41	NOTE	Harmonized as EN 60034-18-41.
IEC/TS 60034-25	NOTE	Harmonized as CLC/TS 60034-25.
IEC 60079-14	NOTE	Harmonized as EN 60079-14.
IEC 60079-17	NOTE	Harmonized as EN 60079-17.
IEC 60079-18	NOTE	Harmonized as EN 60079-18.
IEC 60079-20-1	NOTE	Harmonized as EN 60079-20-1.
IEC 60079-28	NOTE	Harmonized as EN 60079-28.
IEC 60079-29-2	NOTE	Harmonized as EN 60079-29-2.
IEC 60079-30-2	NOTE	Harmonized as EN 60079-30-2.
IEC 60079-35-1	NOTE	Harmonized as EN 60079-35-1.
IEC 60086-1	NOTE	Harmonized as EN 60086-1.
IEC 60095-1	NOTE	Harmonized as EN 60095-1.

IEC 60364-5-55	NOTE	Harmonized in EN 60364-5-55 series.
IEC 60622	NOTE	Harmonized as EN 60622.
IEC 60623	NOTE	Harmonized as EN 60623.
IEC 60664-3	NOTE	Harmonized as EN 60664-3.
IEC 60927	NOTE	Harmonized as EN 60927.
IEC 61008-1	NOTE	Harmonized as EN 61008-1.
IEC 61056-1	NOTE	Harmonized as EN 61056-1.
IEC 61347-2-1	NOTE	Harmonized as EN 61347-2-1.
IEC 61347-2-4	NOTE	Harmonized as EN 61347-2-4.
IEC 61347-2-7	NOTE	Harmonized as EN 61347-2-7.
IEC 61347-2-8	NOTE	Harmonized as EN 61347-2-8.
IEC 61347-2-9	NOTE	Harmonized as EN 61347-2-9.
IEC 61347-2-13	NOTE	Harmonized as EN 61347-2-13.
IEC 61951-1	NOTE	Harmonized as EN 61951-1.
IEC 62013-1	NOTE	Harmonized as EN 62013-1.
ISO 13849-1	NOTE	Harmonized as EN ISO 13849-1.

Foreword to amendment A1

The text of document 31/1301/CDV, future IEC 60079-7:2015/A1, prepared by IEC/TC 31 "Explosive atmospheres" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60079-7:2015/A1:2018.

The following dates are fixed:

- latest date by which the document has to be implemented at (dop) 2018-07-19
national level by publication of an identical national standard
or by endorsement
- latest date by which the national standards conflicting with the (dow) 2021-01-19
document have to be withdrawn

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Endorsement notice

The text of the International Standard IEC 60079-7:2015/A1:2017 was approved by CENELEC as a European Standard without any modification.

European foreword to Amendment A11

This document (EN 60079-7:2015/A11:2024) consists of the text of IEC 60079-7:2015/ISH1:2016, prepared by IEC/TC 31 "Equipment for explosive atmospheres".

The following dates are fixed:

- latest date by which this document has to be (dop) 2025-01-16
implemented at national level by publication of
an identical national standard or by
endorsement
- latest date by which the national standards (dow) 2027-01-16
conflicting with this document have to be
withdrawn

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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 60034-1	—	Rotating electrical machines — Part 1: Rating and performance	EN 60034-1	—
IEC 60044-6	—	Instrument transformers — Part 6: Requirements for protective current transformers for transient performance	EN 60044-6	—
IEC 60061-1	—	Lamp caps and holders together with gauges for the control of interchangeability and safety — Part 1: Lamp caps	EN 60061-1	—
IEC 60061-2	—	Lamp caps and holders together with gauges for the control of interchangeability and safety — Part 2: Lampholders	EN 60061-2	—
IEC 60064	—	Tungsten filament lamps for domestic and similar general lighting purposes - Performance requirements	EN 60064	—
IEC 60068-2-6	—	Environmental testing — Part 2-6: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	—
IEC 60068-2-27	2008	Environmental testing — Part 2-27: Tests - Test Ea and guidance: Shock	EN 60068-2-27	2009
IEC 60068-2-42	—	Environmental testing — Part 2-42: Tests - Test Kc: Sulphur dioxide test for contacts and connections	EN 60068-2-42	—
IEC 60079-0	—	Explosive atmospheres — Part 0: Equipment - General requirements	EN 60079-0	—
IEC 60079-1	—	Explosive atmospheres — Part 1: Equipment protection by flameproof enclosures "d"	EN 60079-1	—
IEC 60079-11	—	Explosive atmospheres — Part 11: Equipment protection by intrinsic safety "i"	EN 60079-11	—
IEC 60079-30-1	—	Explosive atmospheres — Part 30-1: Electrical resistance trace heating - General and testing requirements	EN 60079-30-1	—

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60085	—	Electrical insulation - Thermal evaluation and design	EN 60085	—
IEC 60112	—	Method for the determination of the proof and the comparative tracking indices of solid insulating materials	EN 60112	—
IEC 60216-1	—	Electrical insulating materials - Thermal endurance properties — Part 1: Ageing procedures and evaluation of test results	EN 60216-1	—
IEC 60216-2	—	Electrical insulating materials - Thermal endurance properties — Part 2: Determination of thermal endurance properties of electrical insulating materials - Choice of test criteria	EN 60216-2	—
IEC 60228	—	Conductors of insulated cables	EN 60228	—
IEC 60238	—	Edison screw lampholders	EN 60238	—
IEC 60317-3	2004	Specifications for particular types of	—	—
+A1	2010	winding wires — Part 3: Polyester enamelled round copper wire, class 155	—	—
IEC 60317-8	—	Specifications for particular types of winding wires — Part 8: Polyesterimide enamelled round copper wire, class 180	EN 60317-8	—
IEC 60317-13	—	Specifications for particular types of winding wires — Part 13: Polyester or polyesterimide overcoated with polyamide-imide enamelled round copper wire, class 200	EN 60317-13	—
IEC 60317-46	—	Specifications for particular types of winding wires — Part 46: Aromatic polyimide enamelled round copper wire, class 240	EN 60317-46	—
IEC 60400	—	Lampholders for tubular fluorescent lamps and starters	EN 60400	—
IEC 60432-1	—	Incandescent lamps - Safety specifications — Part 1: Tungsten filament lamps for domestic and similar general lighting purposes	EN 60432-1	—
IEC 60432-2	—	Incandescent lamps - Safety specifications — Part 2: Tungsten halogen lamps for domestic and similar general lighting purposes	EN 60432-2	—
IEC 60432-3	—	Incandescent lamps - Safety specifications - Part 3: Tungsten halogen lamps (non-vehicle)	EN 60432-3	—
IEC 60529	—	Degrees of protection provided by enclosures (IP Code)	—	—
IEC 60598-1	—	Luminaires — Part 1: General requirements and tests	EN 60598-1	—
IEC 60664-1	—	Insulation coordination for equipment within low-voltage systems — Part 1: Principles, requirements and tests	EN 60664-1	—

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60947-1	—	Low-voltage switchgear and controlgear — Part 1: General rules	EN 60947-1	—
IEC 60947-7-1	—	Low-voltage switchgear and controlgear — Part 7-1: Ancillary equipment - Terminal blocks for copper conductors	EN 60947-7-1	—
IEC 60947-7-2	—	Low-voltage switchgear and controlgear — Part 7-2: Ancillary equipment - Protective conductor terminal blocks for copper conductors	EN 60947-7-2	—
IEC 60947-7-4	—	Low-voltage switchgear and controlgear — Part 7-4: Ancillary equipment - PCB terminal blocks for copper conductors	EN 60947-7-4	—
IEC 60998-2-4	—	Connecting devices for low voltage circuits for household and similar purposes — Part 2-4: Particular requirements for twist-on connecting devices	EN 60998-2-4	—
IEC 60999-1	—	Connecting devices - Electrical copper conductors - Safety requirements for screw-type and screwless-type clamping units — Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm ² up to 35 mm ² (included)	EN 60999-1	—
IEC 60999-2	—	Connecting devices - Electrical copper conductors - Safety requirements for screw-type and screwless-type clamping units — Part 2: Particular requirements for clamping units for conductors above 35 mm ² up to 300 mm ² (included)	EN 60999-2	—
IEC 61184	—	Bayonet lampholders	EN 61184	—
IEC 61195	—	Double-capped fluorescent lamps - Safety specifications	EN 61195	—
IEC 61347-1	—	Lamp controlgear - Part 1: General and safety requirement	EN 61347-1	—
IEC 61347-2-3	—	Lamp controlgear — Part 2-3: Particular requirements for a.c. and/or d.c. supplied electronic control gear for fluorescent lamps	EN 61347-2-3	—
IEC 62035	—	Discharge lamps (excluding fluorescent lamps) - Safety specifications	EN 62035	—
ISO 178	—	Plastics - Determination of flexural properties	EN ISO 178	—
ISO 527-2	—	Plastics - Determination of tensile properties - Part 2: Test conditions for moulding and extrusion plastics	EN ISO 527-2	—
ISO 2859-1	—	Sampling procedures for inspection by attributes - Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection	—	—

Annex ZZ (informative)

Relationship between this European standard and the essential requirements of 2014/34/EU [2014 OJ L96] aimed to be covered

This European Standard has been prepared under a Commission's standardisation request M/BC/CEN/92/46 to provide one voluntary means of conforming to essential requirements of 2014/34/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres (recast).

Once this standard is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of this standard given in [Table ZZ.1](#) confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

Table ZZ.1 — Correspondence between this European standard and Annex II of Directive 2014/34/EU [2014 OJ L96]

<i>Essential Requirements of 2014/34/EU</i>	Clause(s) / sub-clause(s) of this EN	Remarks / Notes
1.0.1.	All clauses	This is the purpose of the Standard.
1.0.2.	4.2 / 4.3 / 4.4 / 4.6 / 5.2 / 5.3 / 5.4 / 5.6 / 5.8 / 5.9 / A.3 / A.5 / B.4.2	
1.0.2.	4 / 5 / A/B//F/G//H	
1.0.3.	5.2 / 5.3 / 5.6	
1.0.3.	5.2 / 5.3 / 5.6	
1.0.4.	4.2 / 4.6 / 4.8	
1.0.4.	4.2 / 4.6 / 4.8	
1.0.5.	5.2 / 5.3 / 5.7 / 5.9 / 8.1 / 8.2 / 9.4	
1.0.5.	9	
1.0.6.	5.7 / 8.2	
1.0.6.	9.3	
1.1.1.	5.6 / 4.2	
1.1.1.	4.2 / 5.6 /	
1.1.2.	4.6 / 4.7 / 5.2 / 5.3 / 5.6 / 6.6	
1.1.2.	4.6 / 4.7 / 5.2 / 5.3 / 5.6 / 5.8 / 6.6	
1.1.3.	4.2 / 4.3 / 4.9 / 5.2 / 5.3 / 5.6 / 5.8 / 6.1 / 6.6 / 6.7 / 6.8 / 7	
1.1.3.	4.2 / 4.3 / 4.5 / 4.8 / 4.9 / 5.2 / 5.3 / 5.6 / 5.8 / 6.1 / 6.3 / 6.6 / 6.7 / 6.8 / 7	
1.2.1.	All clauses of the standard contain up-to-date requirements	
1.2.2.	5.3 / 5.6 / 5.9	
1.2.3.	5.6 / 6.6 / 6.7	
1.2.4.	—	

<i>Essential Requirements of 2014/34/EU</i>	Clause(s) / sub-clause(s) of this EN	Remarks / Notes
1.2.5.	4.10 / 5.3 / B.1	
1.2.5.	4.10 / 5.3 / 5.6 / B.1	
1.2.6.	4.11	Fasteners according to IEC 60079-0
1.2.7.	4.8 / 5.6 / B.4	EN 60079-0 and relevant standards for normal industrial applications.
1.2.8.	5.2 / 5.3 / 5.6 / 5.8 / 5.9	
1.2.8.	5	
1.2.9.	—	
1.3.1.	4.2 / 4.4 / 4.6 / 5.3 / 5.6 / 6.8	
1.3.2.	—	
1.3.3.	4.4 / 5.3 / 5.6	
1.3.4.	5.2	
1.3.4.	4.10 / 5.2	
1.3.5.	—	
1.4.1.	4.2 / 4.11 / 5.3 / 6.2 / 6.3 / 6.4	Fasteners according to IEC 60079-0
1.4.1.	4.2 / 4.10 / 4.11 / 5.3 / 6.2 / 6.3 / 6.4	Fasteners according to IEC 60079-0
1.4.2.	4.2 / 4.3 / 4.6 / 4.9 / 5.2 / 5.3 / 5.6 / 5.8 / 6.2 / 6.3 / 6.8	
1.4.2.	4.2 / 4.3 / 4.6 / 4.9 / 4.10 / 5.2 / 5.3 / 5.6 / 5.8 / 6.2 / 6.3 / 6.8	
1.5.1	5.2 / 5.8 / 6.2	
1.5.2.	5.2 / 5.8 / 6.2	
1.5.3.	5.2 / 5.8 / 6.2	
1.5.4.	5.2 / 5.8 / 6.2	
1.5.5.	5.2 / 5.8 / 6.2	
1.5.6.	5.2 / 5.8 / 6.2	
1.5.7.	5.2 / 5.8 / 6.2	
1.5.8.	5.2 / 5.8 / 6.2	
1.6.1.		
1.6.2.		
1.6.3.		
1.6.4.		
1.6.5.		
1.6.1.	9	
1.6.2.	9	
1.6.3.	9	
1.6.4.	9	
1.6.5.	9	
2.0.1.1.	—	
2.0.1.2.	—	
2.0.1.3.	—	
2.0.1.4.	—	
2.0.2.1.	4.11 / 5.3	

<i>Essential Requirements of 2014/34/EU</i>	Clause(s) / sub-clause(s) of this EN	Remarks / Notes
2.0.2.1.	4.10 / 4.11 / 5.3	
2.0.2.2.	—	
2.0.2.2.	9	
2.0.2.3	4.11 / 6.1 / 7.1	
2.0.2.3	4.10 / 4.11 / 6.1 / 7.1	
2.1.1.1.	—	
2.1.1.2.	—	
2.1.1.3.	—	
2.1.2.1.	—	
2.1.2.2.	—	
2.1.2.3.	—	
2.2.1.1.	—	
2.2.1.1.	-5	
2.2.1.2.	—	
2.2.1.2.	4/5	
2.2.1.3.	—	
2.2.1.3.	4.2/5.9/9	
2.2.2.1	—	
2.2.2.2.	—	
2.2.2.3.	—	
2.2.2.4.	—	
2.3.1.1.	—	
2.3.1.1.	4/5	
2.3.1.2.	—	
2.3.1.2.	4/5/9	
2.3.2.1.	—	
2.3.2.2.	—	
2.3.2.3.	—	
3.0.1.	—	
3.0.2.	—	
3.0.3.	—	
3.0.4.	—	
3.1.1.	—	
3.1.2.	—	
3.1.3.	—	
3.1.4.	—	
3.1.5.	—	
3.1.6.	—	
3.1.7.	—	
3.1.8.	—	

WARNING 1 — Presumption of conformity stays valid only as long as a reference to this European standard is maintained in the list published in the Official Journal of the European Union. Users of this standard should consult frequently the latest list published in the Official Journal of the European Union.

WARNING 2 — Other Union legislation may be applicable to the product(s) falling within the scope of this standard.

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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 non-governmental 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 60079-7 has been prepared by IEC Technical Committee 31: Equipment for explosive atmospheres.

This fifth edition cancels and replaces the fourth edition published in 2006, and constitutes a technical revision.

The requirements for Type of Protection “nA” have been relocated from IEC 60079-15. To assist the user of this document, the significant changes with respect to the previous edition are shown below in two separate tables, one showing the changes from IEC 60079-7, Edition 4 (2006) for “e” to IEC 60079-7, Edition 5 (2014) for “eb”; and the other showing the changes from IEC 60079-15, Edition 4 (2010) for “nA” to IEC 60079-7, Edition 5 (2014) for “ec”.

The significance of the changes between IEC Standard, IEC 60079-7, Edition 5 (2014) (for “eb”) and IEC 60079-7, Edition 4 (2006) (for “e”) are as listed below:

for “e” to “eb”		Type		
Explanation of the significance of the changes	Clause	Minor and editorial changes	Extension	Major technical changes
Scope Clarification of applicability Notes added to address short circuits and short-term thermal excursions	1	X		
Clarification of resistance heating definitions	3.13	X		
Addition of terminal insulation material tests	4.2.2.4			C1
Soldered Connections	4.2.2.5 4.2.3.3			C2
Silver-Soldered connections	4.2.3.3	X		
Clarification of “duplicated” contacts	4.2.3.4a)	X		
External plug and socket connections for field wiring connection of batteries	4.2.4	X		
Clarification of conditions for the determination of maximum surface temperature	4.8.1 Table 3	X		
Maximum temperatures for insulated windings	Table 4	X		
Degrees of protection provided by enclosures	4.10.1		x	C3
Clarification of applicability	5.2.1	X		
Minimum air gap for motors	5.2.6	X		
Devices for limiting winding temperature protection	5.2.8.2 5.2.8.3		X	
Permanent magnet motors	5.2.9 6.2.4 9.3.4c)		X	
Added Tungsten-Halogen lamp	5.3.2.2 5.3.2.3 5.3.2.4		X	
Added spacings for < 10 W lamps	5.3.3		X	
Permission added for re-lamping outside of hazardous area	5.3.5.2.2		X	
Added bayonet lamps	5.3.5.4.2		X	
Added contact requirements for bayonet lamps	5.3.5.5		X	
Renaming of “Type” of cells and batteries	5.6.2	X		
Clarification of approaches for general purpose junctions boxes	5.7 6.9 Annex E	X		
Clarified temperature monitoring and control	5.8	X		
Clarification of testing of battery powered luminaires	6.3.1	X		
Clarification of impact tests	6.3.2.2	X		
Added abnormal tests for discharge lamps	6.3.4.1			C4
Added T5 8W	6.3.4.3 Table 16		X	

for “e” to “eb”		Type		
Explanation of the significance of the changes	Clause	Minor and editorial changes	Extension	Major technical changes
To maintain T4 temperature class, cathode power or ambient temperature reduced	6.3.4.3 Table 16			C5
Clarification of routine tests for terminal boxes	7.1	X		
Marking of “e” replaced by “eb”	9.1	See “Information about the background of Changes”		
Ex Component enclosures	9.2			C6
Highlight essential documentation for rotating electrical machines	10	X		
Temperature tests	Annex A		X	

The significance of the changes between IEC Standard, IEC 60079-7, Edition 5 (2015) (for “ec”) and IEC 60079-15, Edition 4 (2010) (for “nA”) are as listed below:

for “nA” to “ec”		Type		
Explanation of the significance of the changes	Clause	Minor and editorial changes	Extension	Major technical changes
Scope	1	X		
Clarification of applicability				
Notes added to address short circuits and short-term thermal excursions				
Clarification of resistance heating definitions	3.13	X		
Soldered Connections	4.2.2.5 4.2.3.3			C7
Silver-Soldered connections	4.2.3.3	X		
Evaluation of pluggable connections	4.2.3.5a)	X		
External plug and socket connections for field wiring connection	4.2.4	X		
Minimum separation distances for encapsulated or solid insulation replaced by requirements for solid insulating materials	4.3 4.4 4.5 Table 2	X		
Alternative separation distances for equipment under controlled environments	4.3 4.4 Annex H		X	
Thermal stability of solid insulating materials	4.6			C8
Clarification of conditions for the determination of maximum surface temperature	4.8.1 Table 3	X		
Maximum temperatures for insulated windings	Table 4	X		
Clarification of applicability	5.2.1	X		
Permanent magnet motors	5.2.9 6.2.4 9.3.4c)		X	

for “nA” to “ec”		Type		
Explanation of the significance of the changes	Clause	Minor and editorial changes	Extension	Major technical changes
Clarified applicability to handlights and caplights	5.3	X		
Addition of permitted light sources	5.3.2 Annex J		X	
Added spacings for < 10 W & 100-200 W lamps	5.3.4		X	
Added LED as a light source	5.3.2.5 0		X	
Clarified internal spacings for LED packages	0	X		
Added spacings for < 10 V lamps	5.3.5.3.2		X	
Clarification of temperature testing	5.3.7	X		
Renaming of “Type” of cells and batteries	5.6.1	X		
Clarification of approaches for general purpose junctions boxes	5.7 6.8 Annex E	X		
Clarified temperature monitoring and control	5.8	X		
Clarification of permitted fuses	5.9.1	X		
Clarification of testing of battery powered luminaires	6.3.1	X		
Addition of end-of-life tests	6.3.4.3.2 Table 16			C9
Dielectric tests based on industrial standards	7.1		X	
Clarification of routine tests for terminal boxes	7.1	X		
Marking of “nA” is replaced by “ec”	9.1	See “Information about the background of Changes”		
Ex Component enclosures	9.2			C10
Highlight essential documentation for rotating electrical machines	10	X		
Temperature tests	Annex A		X	
Alternative separation distances	Annex H	A1		

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.

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 'Changes

Marking:

Former marking of "nA" has been replaced by marking "ec". Even if the other technical aspects on the product are unchanged and comply with the revised requirements, a change in the marking will be required.

Former marking of "e" has been replaced by marking "eb". Even if the other technical aspects on the product are unchanged and comply with the revised requirements, a change in the marking will be required.

- A1 The text of [Annex H](#) for *Alternative separation distances for Level of Protection "ec" equipment under controlled environments* has been reorganized and clarified from Clause 13 of IEC 60079-15, Ed 4; to facilitate consistent application of the requirements. The title has been revised to remove "low power" as power is not relevant for insulation coordination in accordance with IEC 60664-1. Although a clarification, it is recognized that some existing equipment may not meet the clarified requirement.
- C1 The terminal insulating materials are now subjected to the same tests as rail-mounted terminals as a failure of the material presents the same hazard.
- C2 Although a clarification, it is recognized that some existing equipment will not meet the clarified requirement. The requirements for soldered connections were revised to specify that mechanical support of the connection was required in addition to the solder. It is not a requirement that the connection function electrically in the absence of the solder.
- C3 Ingress protection requirements for Group I increased from IP20 to IP23 for consistency with the remainder of the document.
- C4 Added abnormal tests for discharge lamps.
- C5 Based on further research, maintaining temperature class T4, under conditions of end-of-life, requires either the cathode power or the ambient temperature be reduced.
- C6 Requirements for Ex Component "e" enclosures introduced based on those for Ex Component "d" enclosures. Even if the other technical aspects on the product are unchanged and comply with the revised requirements, a change in the marking will be required.
- C7 Although a clarification, it is recognized that some existing equipment may not meet the clarified requirement. The requirements for soldered connections were revised to specify that mechanical support of the connection was required in addition to the solder. It is not a requirement that the connection function electrically in the absence of the solder.

C8 Requirements added for the use of solid insulating materials within the limits of their thermal stability.

C9 Based on further research, requirements for T5 lamps added.

C10 Requirements for Ex Component “e” enclosures introduced based on those for Ex Component “d” enclosures. Even if the other technical aspects on the product are unchanged and comply with the revised requirements, a change in the marking will be required.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A 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 the base publication and its amendment 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.

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Explosive atmospheres —

Part 7: Equipment protection by increased safety "e"

1 Scope

This part of IEC 60079 specifies the requirements for the design, construction, testing and marking of electrical equipment and Ex Components with type of protection increased safety "e" intended for use in explosive gas atmospheres.

Electrical equipment and Ex Components of type of protection increased safety "e" are either:

- a) Level of Protection "eb" (EPL "Mb" or "Gb"); or
- b) Level of Protection "ec" (EPL "Gc")

Level of Protection "eb" applies to equipment or Ex Components, including their connections, conductors, windings, lamps, and batteries; but not including semiconductors or electrolytic capacitors.

NOTE 1 The use of electronic components, such as semiconductors or electrolytic capacitors, is excluded from Level of Protection "eb" as expected malfunctions could result in excessive temperatures or arcs and sparks if the internal separation distances were not applied. It is not generally practical to maintain those separation distances and maintain the function of the electronic component.

Level of Protection "ec" applies to equipment or Ex Components, including their connections, conductors, windings, lamps, and batteries; and also including semiconductors and electrolytic capacitors.

NOTE 2 The use of electronic components, such as semiconductors or electrolytic capacitors, is permitted in Level of Protection "ec" as these are evaluated under both normal conditions and regular expected occurrences, and are not likely to result in excessive temperatures or arcs and sparks. As the requirements for separation distances are not applied to the internal construction, commercially available electronic components are generally suitable if the external separation distances comply.

The requirements of this standard apply to both Levels of Protection unless otherwise stated.

For Level of Protection "eb", this standard applies to electrical equipment where the rated voltage does not exceed 11 kV r.m.s., a.c. or d.c.

For Level of Protection "ec", this standard applies to electrical equipment where the rated voltage does not exceed 15 kV r.m.s., a.c. or d.c.

NOTE 3 Short circuit currents flowing through increased safety connections of mains circuits are not considered to create a significant risk of ignition of an explosive gas atmosphere due to movement of connections as a result of mechanical stresses created by the short circuit current. Normal industrial standards require that the effects of short time high currents on the security of connections be considered. The presence of the explosive gas atmosphere does not adversely affect the security of the connection.

NOTE 4 Any short term thermal excursions that occur as a result of electrical current excursions above normal rated currents, such as those that occur during the starting of motors, are not considered to create a significant risk of ignition of an explosive gas atmosphere due to the relatively short duration of the event and the convection that occurs during the event.

NOTE 5 High-voltage connections and associated wiring (above 1 kV) can be susceptible to increased partial discharge activity that could be a source of ignition. Increased spacings to earthed surfaces or other connections and provision of suitable high-voltage stress relief for the terminations are typically provided.

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.

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 60034-1, *Rotating electrical machines — Part 1: Rating and performance*

IEC 60044-6, *Instrument transformers — Part 6: Requirements for protective current transformers for transient performance*

IEC 60061-1, *Lamp caps and holders together with gauges for the control of interchangeability and safety. Part 1: Lamp caps*

IEC 60061-2, *Lamp caps and holders together with gauges for the control of interchangeability and safety — Part 2: Lampholders*

IEC 60064, *Tungsten filament lamps for domestic and similar general lighting purposes — Performance requirements*

IEC 60068-2-6, *Environmental testing — Part 2-6: Tests — Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27:2008, *Environmental testing — Part 2-27: Tests — Test Ea and guidance: Shock*

IEC 60068-2-42, *Environmental testing — Part 2-42: Tests — Test Kc: Sulphur dioxide test for contacts and connections*

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

IEC 60079-1, *Explosive atmospheres — Part 1: Equipment protection by flameproof enclosures "d"*

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

IEC 60079-30-1, *Explosive atmospheres — Part 30-1: Electrical resistance trace heating — General and testing requirements*

IEC 60085, *Electrical insulation — Thermal evaluation and designation*

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

IEC 60216-1, *Electrical insulating materials — Thermal endurance properties — Part 1: Ageing procedures and evaluation of test results*

IEC 60216-2, *Electrical insulating materials — Thermal endurance properties — Part 2: Determination of thermal endurance properties of electrical insulating materials — Choice of test criteria*

IEC 60228, *Conductors of insulated cables*

IEC 60238, *Edison screw lampholders*

IEC 60317-3:2004, *Specifications for particular types of winding wires — Part 3: Polyester enamelled round copper wire, class 155 IEC 60317-3:2004/AMD1:2010*

IEC 60317-8, *Specifications for particular types of winding wires — Part 8: Polyesterimide enamelled round copper wire, class 180*

IEC 60317-13, *Specifications for particular types of winding wires — Part 13: Polyester or polyesterimide overcoated with polyamide-imide enamelled round copper wire, class 200*

IEC 60317-46, *Specifications for particular types of winding wires — Part 46: Aromatic polyimide enamelled round copper wire, class 240*

IEC 60400, *Lampholders for tubular fluorescent lamps and starterholders*

IEC 60432-1, *Incandescent lamps — Safety specifications — Part 1: Tungsten filament lamps for domestic and similar general lighting purposes*

IEC 60432-2, *Incandescent lamps — Safety specifications — Part 2: Tungsten halogen lamps for domestic and similar general lighting purposes*

IEC 60432-3, *Incandescent lamps — Safety specifications — Part 3: Tungsten halogen lamps (non-vehicle)*

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

IEC 60598-1, *Luminaires — Part 1: General requirements and tests*

IEC 60664-1, *Insulation coordination for equipment within low-voltage systems — Part 1: Principles, requirements and tests*

IEC 60947-1, *Low-voltage switchgear and controlgear — Part 1: General rules*

IEC 60947-7-1, *Low-voltage switchgear and controlgear — Part 7-1: Ancillary equipment — Terminal blocks for copper conductors*

IEC 60947-7-2, *Low-voltage switchgear and controlgear — Part 7-2: Ancillary equipment — Protective conductor terminal blocks for copper conductors*

IEC 60947-7-4, *Low-voltage switchgear and controlgear — Part 7-4: Ancillary equipment — PCB terminal blocks for copper conductors*

IEC 60998-2-4, *Connecting devices for low-voltage circuits for household and similar purposes — Part 2-4: Particular requirements for twist-on connecting devices*

IEC 60999-1, *Connecting devices — Electrical copper conductors — Safety requirements for screw-type and screwless-type clamping units — Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm² up to 35 mm² (included)*

IEC 60999-2, *Connecting devices — Electrical copper conductors — Safety requirements for screw-type and screwless-type clamping units — Part 2: Particular requirements for clamping units for conductors above 35 mm² up to 300 mm² (included)*

IEC 61184, *Bayonet lampholders*

IEC 61195, *Double-capped fluorescent lamps — Safety specifications*

IEC 61347-1, *Lamp controlgear — Part 1: General and safety requirements*

IEC 61347-2-3, *Lamp control gear — Part 2-3: Particular requirements for a.c. and/or d.c. supplied electronic control gear for fluorescent lamps*

IEC 62035, *Discharge lamps (excluding fluorescent lamps) — Safety specifications*

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 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

ISO 178, *Plastics — Determination of flexural properties*

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 For the definitions of any other terms, particularly those of a more general nature, please refer to IEC 60050-426 or other appropriate parts of IEC 60050, *International Electrotechnical Vocabulary*.

3.1 cell and battery types

3.1.1

sealed cell

cell which remains closed and does not release either gas or liquid when operated within the limits specified by the manufacturer

Note 1 to entry: A sealed cell is often equipped with a safety device to protect against a dangerously high internal pressure and is designed to operate during its life in its original sealed state.

Note 2 to entry: A sealed cell was formerly known as a Type 1 cell in IEC 60079-15.

3.1.2

valve-regulated cell or battery

secondary cell or battery which is closed under normal conditions but which has an arrangement which allows the escape of gas if the internal pressure exceeds a predetermined value

Note 1 to entry: The cell cannot normally receive an addition to the electrolyte.

Note 2 to entry: A valve-regulated cell or battery was formerly known as a Type 2 cell in IEC 60079-15.

3.1.3

vented cell or battery

secondary cell or battery having a cover provided with an opening through which products of electrolysis and evaporation are allowed to escape freely from the cell or battery to the atmosphere

Note 1 to entry: A vented cell or battery was formerly known as a Type 3 cell in IEC 60079-15.

3.2

duty type (motor)

continuous, short-time or periodic duty, comprising one or more loads remaining constant for the duration specified, or a non-periodic duty in which generally load and speed vary within the permissible operating range

Note 1 to entry: These include duty types S1 to S10, as defined in IEC 60034-1.

3.3

ferrule

metal tube crimped over stranded wire to secure it within a terminal usually with electrical insulation protecting any exposed portion of the wire not completely inside the terminal post

3.4

fuse

device that by the fusing of one or more of its specially designed and proportioned components intended to melt under the action of current exceeding some definite value for a definite period of time, opens the circuit in which it is inserted by breaking the current when this exceeds a given value for a sufficient time

3.5

increased safety "e"

type of protection applied to electrical equipment or Ex Components in which additional measures are applied so as to give increased security against the possibility of excessive temperatures and against the occurrence of arcs and sparks

3.6

initial starting current

I_A

highest r.m.s. value of current drawn by an a.c. motor when at rest or by an a.c. magnet with its armature clamped in the position of maximum air gap when supplied at rated voltage and rated frequency

Note 1 to entry: Transient phenomena are ignored.

3.7**Light Emitting Diode****LED**

solid state device embodying a p-n junction, emitting optical radiation when excited by an electric current

3.8**LED module**

light source having no cap, incorporating one or more LED package(s) on a printed circuit board, and possibly including one or more of the following: electrical, optical, mechanical, and thermal components, interfaces, and controlgear

3.9**LED package**

single electrical component encapsulating principally one or more LEDs, possibly with optical elements and thermal, mechanical, and electrical interfaces

Note 1 to entry: The component does not include the control unit of the controlgear, does not include a cap, and is not connected directly to the supply voltage.

Note 2 to entry: An LED package is a discrete component and part of the LED module or LED lamp.

3.10**normal service**

(machines) continuous operation at the nameplate rating (or set of ratings) generally including starting conditions

Note 1 to entry: Normal service for Level of Protection “ec” motors of duty types S1 or S2 does not include starting.

3.11**rated dynamic current** **I_{dyn}**

peak value of the current, the dynamic effect of which the electrical equipment can sustain without damage

3.12**rated short-time thermal current** **I_{th}**

r.m.s. value of the current required to heat up the conductor within 1 s from the temperature reached in rated service at the maximum ambient temperature to a temperature not exceeding the limiting temperature

3.13 resistance-heating applications**3.13.1****resistance-heating**

utilization of electric resistance-heating devices, units and any associated controls (other than electrical trace heating systems)

Note 1 to entry: Electric trace heating systems are addressed by IEC 60079-30-1.

3.13.2**resistance-heating device**

part of a resistance heating unit consisting of one or more heating resistors, typically composed of metallic conductors or an electrically conductive material suitably insulated and protected

Note 1 to entry: An example of a resistance heating device covered by this standard is an anti-condensation heater.

3.13.3

resistance-heating unit

equipment consisting of an assembly of one or more resistance heating devices associated with any safety devices necessary to ensure that the limiting temperature is not exceeded

Note 1 to entry: It is not intended that the safety devices necessary to ensure that the limiting temperature is not exceeded should have Type of Protection “e” or any type of protection when they are located outside the hazardous area.

3.13.4

workpiece

object to which a resistance-heating device or resistance-heating unit is applied

3.13.5

temperature self-limiting characteristic

characteristic whereby the thermal output of a resistance-heating device at its rated voltage decreases as the temperature of its surroundings increases until the device reaches a temperature at which its thermal output is reduced to a value at which there is no further rise in temperature

Note 1 to entry: The temperature of the surface of the element is then effectively that of its surroundings.

3.13.6

stabilized design

design where the temperature of the resistance-heating device or resistance-heating unit will, by design and use, stabilize below the limiting temperature, under the most unfavourable conditions, without the need for a safety device to limit the temperature

3.14

short-circuit current

I_{sc}

maximum r.m.s. value of the short-circuit current to which the equipment may be subjected in service

Note 1 to entry: This maximum value is recorded in the documentation prepared according to IEC 60079-0.

3.15

solid insulation

electrical insulation material, which is extruded or moulded, but not poured

Note 1 to entry: Insulators fabricated from two or more pieces of electrical insulating material, which are solidly bonded together can be considered as solid. The term solid insulation describes the final form and not necessarily the form in which they are initially applied. For windings of electrical machines, the process of using varnish as a means of consolidating and insulating the winding is considered to result in solid insulation, irrespective of how the varnish is applied.

3.16

starting current ratio

I_A/I_N

ratio between initial starting current I_A and rated current I_N

3.17

stator winding

stationary winding in an electric machine, either for rotary or linear motion

3.18

time

t_E

time, in seconds, taken for an a.c. rotor or stator winding, when carrying the initial starting current I_A , to be heated up to the limiting temperature from the temperature reached in rated service at the maximum ambient temperature (see [Figure A.1](#))

3.19**trace heater**

device designed for the purpose of producing heat on the principle of electrical resistance and typically composed of one or more metallic conductors or an electrically conductive material suitably electrically insulated and protected

Note 1 to entry: For additional information on trace heaters, see IEC 60079-30-1.

3.20**terminal**

point of interconnection of an electric circuit element, a circuit, or a network with other electric circuit elements, electric circuits or networks

3.21**safety device**

device intended for use inside or outside explosive atmospheres but required for, or contributing to, the safe functioning of equipment and protective systems with respect to the risks of explosion

Note 1 to entry: TC31 has initiated a project to consider the development of an IEC standard based on EN 50495 which would provide requirements for these safety devices.

3.22**transportable**

capable of being moved from one location to another, generally by using vehicles

4 Constructional requirements**4.1 Level of Protection**

Electrical equipment with Type of Protection increased safety “e” shall be one of the following:

- Level of Protection “eb” (EPL “Mb” or “Gb”); or
- Level of Protection “ec” (EPL “Gc”).

The requirements of this clause apply, unless otherwise stated in [Clause 5](#), to all electrical equipment and Ex Components with Type of Protection “e”.

4.2 Electrical connections**4.2.1 General**

Electrical connections intended to be terminated internal to the equipment enclosures are subdivided into those for field-wiring, [4.2.2](#), and for factory wiring, [4.2.3](#), and into permanent types and reconnectable/rewireable types for convenience in detailing the appropriate requirements.

External earthing and equipotential bonding connections shall comply with the requirements for field wiring connections, [4.2.2](#).

Each type shall, as applicable:

- a) be constructed in such a way that the conductors cannot slip out from their intended location during tightening of a screw or after insertion;
- b) provide a means to avoid loosening of the connection in service;
- c) be such that contact is assured without damage to the conductors such that would impair the ability of the conductors to fulfil their function, even if multi-stranded conductors are used in connections intended for direct clamping of a single conductor;

- d) provide a positive compression force to assure contact pressure in service;
- e) be constructed in such a way that the contact they assure is not appreciably impaired by temperature changes occurring in normal service;
- f) except as permitted by the earth continuity test of IEC 60079-0, provide contact pressure that does not depend on the structural integrity of insulating materials;
- g) not be specified to accommodate more than one individual conductor in a clamping point unless specifically designed and assessed for doing so;
- h) if intended for stranded conductors, employ a means to protect the conductors and distribute the contact pressure evenly. The method of applying contact pressure shall be capable, on installation, of reliably forming the stranded conductor into an effectively solid shape that does not subsequently change in service. Alternatively, the method of applying the contact pressure should be such that it is designed to accommodate any settlement of the strands in service;
- i) for screw connections, have a torque value specified by the manufacturer;
- j) for screwless connections intended for class 5 and/or class 6 fine-stranded conductors according to IEC 60228, the fine-stranded conductor shall be equipped with a ferrule or the termination shall have a method to open the clamping mechanism so that the conductors are not damaged during the installation of the conductor.

NOTE 1 The use of aluminium wire can cause difficulties by compromising critical creepage and clearance distances when anti-oxidant materials are applied. The connection of aluminium wire to terminals is typically by the use of suitable bi-metallic connection devices providing a copper connection to the terminal.

NOTE 2 Special precautions against vibration and mechanical shock are often applied to reduce the risk of loosening.

NOTE 3 Electrolytic corrosion where ferrous materials are used can occur. Guidance on limitation of corrosion based on the limitation of electrochemical potential between dissimilar metals can be found in IEC TR 60943.

NOTE 4 The limiting temperature of the insulation of terminal blocks and accessories will usually be based on the limiting temperature of the insulation in accordance with item a) of [4.8.2](#) but the limiting temperature allocated to the terminal when used in equipment will also depend on the maximum cable insulation temperature rating of the cable which is to be connected.

4.2.2 Field wiring connections

4.2.2.1 General

Terminals for field wiring shall be dimensioned to allow the effective connection of conductors of cross-section equal to at least that required for the rated current of the electrical equipment.

Connections shall be located in a position so that when required to be inspected in service they are reasonably accessible.

The number, size, and type of conductors that can be safely connected shall be specified in the documentation prepared in accordance with IEC 60079-0.

NOTE 1 The 'type of conductor' includes features such as conductor material and stranding.

NOTE 2 Some types of cables, such as those used to conform to EMC requirements, include multiple earthing conductors. Facilities might be required for the termination of more earthing conductors than would normally be expected. In these cases, it is important that the user and the manufacturer coordinate the termination facilities to be provided.

4.2.2.2 Connections made using terminals conforming to IEC 60947-7-1, IEC 60947-7-2, IEC 60947-7-4, IEC 60999-1, or IEC 60999-2

Such terminals are intended for the connection of copper conductors with the insulation locally removed and without the addition of intermediate parts other than those replicating the form of a bare conductor, such as a ferrule.

Terminals in Level of Protection “eb” shall be subject to the terminal insulation material tests of [6.10](#).

Terminals shall be capable of being fixed in their mountings.

For terminals in Level of Protection “eb”, the temperature rise of the conductor bar shall not exceed 40 K at a test current of 110 % of rated current according to the method of the temperature-rise test of IEC 60947-7-1.

NOTE 1 This test relates to the absolute maximum current rating of the terminal when tested without any enclosure. For practical purposes, when terminals are used in multiples within enclosures, it will be necessary to establish reduced current ratings according to the particular circumstances. See [5.8](#), [6.8](#) and [Annex E](#).

Terminals for connecting conductors of rated cross-section not exceeding 35 mm² (2 AWG) shall also be suitable for the effective connection of conductors at least two ISO wire sizes smaller, in accordance with [Annex E](#), if not otherwise specified in the certificate.

NOTE 2 [Subclause 4.2.2.2](#) is primarily intended to give requirements for terminals as Ex Components.

4.2.2.3 Integral field wiring connection facilities

Integral field wiring connection facilities shall meet the requirements of [4.2.2.2](#), as applicable.

NOTE 1 The connection facilities for equipment or Ex Components employing other types of protection, such as flameproof enclosure “d”, permit installation using increased safety “e” as the connection method.

NOTE 2 The 40 K rise referred to in [4.2.2.2](#) is only for the Ex Component evaluation of terminals and is not determined in the actual application of the terminal, where a rise of more than 40 K may be observed.

4.2.2.4 Connections designed to be used with cable lugs and similar devices

Such connections shall be fixed in their mountings.

Terminals shall meet the requirements of [4.2.2.1](#).

Terminals in Level of Protection “eb” shall be subject to the terminal insulation material tests of [6.10](#).

A means of securing the cable or conductors to prevent rotation or movement shall be provided to avoid either loosening or compromising creepage and clearance. Alternatively, the certificate number 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 provisions for securing the cable or conductors to avoid compromising creepage and clearance, and the provisions to avoid loosening of the connections. If the option to use marking instead of the “X” suffix is employed in accordance with IEC 60079-0, this marking may appear on either the exterior or the interior of the connection compartment.

NOTE Conductors of greater than 35 mm² can provide sufficient rigidity to avoid compromising creepage and clearance.

4.2.2.5 Connections using permanent arrangements

These connections are typically individual conductors (flying leads) that are intended to be terminated during installation using appropriate connection methods, see [4.2.1](#). Either a means of fixing the completed connections to a suitable location is to be provided or the completed connections are to be provided with means of reliably insulating them to the requirements of this standard.

If the method of connection is by soldering, a method of providing mechanical support of the completed connection, in addition to the solder, shall be provided. The mechanical support of the connection shall not be permitted to rely solely on the solder.

NOTE The intent of the mechanical support is to avoid mechanical stresses being transferred to the electrical connection.

4.2.3 Factory connections

4.2.3.1 General

Factory connections shall be either fixed in a specific location or be provided with means of meeting the creepage and clearance requirements of this standard.

Any of the connection methods suitable for use as field wiring connections may be used for a factory connection, except in this case, the terminal insulation material tests of 6.10 need not be conducted for either Level of Protection “eb” or “ec”.

NOTE The requirements for the thermal stability of the insulating material are given in [4.6](#).

4.2.3.2 Twist-on connectors for Level of Protection “ec”

In addition to the connection methods suitable for field wiring connections, twist-on connecting devices meeting the requirements of IEC 60998-2-4 may also be used for factory connections in Level of Protection “ec”.

4.2.3.3 Permanent connections

Permanent connections shall only be made by:

- a) crimping;
- b) brazing;
- c) welding;
- d) soldering, with mechanical support of the completed connection, in addition to the solder, provided; or
- e) In Level of Protection “ec”, printed circuit board mounted components, including surface-mount and through-hole mount components, **without** additional mechanical support

NOTE The process commonly referred to as 'silver soldering' is considered 'brazing'.

4.2.3.4 Pluggable connections for Level of Protection “eb”

These connections are designed to be readily connected or disconnected during assembly, maintenance, or repair.

NOTE 1 These connections are not intended to be connected or disconnected when an explosive atmosphere is present.

NOTE 2 Typical examples are plug-in components, and card edge connectors.

Pluggable connections in Level of Protection “eb” shall provide the following:

- a) each connection shall employ at least two areas of contact where the loss of one area of contact does not compromise the effectiveness of the other;

- b) if the factory connection can remain energized when separated, it shall be provided with an interlock to prevent separation when energized or shall be marked in accordance with item a) of [Table 19](#). For small items, adjacent marking can be provided; and
- c) Connection secureness of either
- each connection or group of connections shall be provided with a mechanical retaining device, which, excluding internal friction, provides a force resisting separation of at least 30 N with the force applied gradually near the centre of the component. Where a group of individual connections is mechanically linked and the separable component weighs more than 0,25 kg or carries more than 10 conductors, special consideration shall be given to the security of the connection; or

NOTE 3 It is the intent that the effectiveness of the mechanical retention for Level of Protection “eb” be evaluated by test due to the increased risk of ignition due to separation of contacts in equipment of EPL Gb.

- for a connecting component relying on friction to remain in place and not attached in any way outside of the connection points, the separating force in Newtons shall be greater than 200 times the weight (in kg) of the component, with the force applied gradually near the centre of the component. In this case, a mechanical retaining device is not required.

4.2.3.5 Pluggable connections for Level of Protection “ec”

These connections are designed to be readily connected or disconnected during assembly, maintenance, or repair.

NOTE 1 These connections are not intended to be connected or disconnected when an explosive atmosphere is present.

NOTE 2 Typical examples are connectors, plug-in components, and card edge connectors.

Sockets of pluggable connection for Level of Protection “ec”, which in normal operation do not have a plug inserted and which are intended to be used only for maintenance and repairing, are evaluated without the mating part inserted.

Pluggable connections in Level of Protection “ec” shall provide connection secureness using either of the following:

- a) Each connection or group of connections shall be provided with a mechanical retaining device, excluding internal friction, or shall provide a force resisting separation of at least 15 N with the separating force applied gradually near the centre of the component. Where a group of individual connections is mechanically linked and the separable component weighs more than 0,25 kg or carries more than 10 conductors, special consideration shall be given to the security of the connection.

A means to evaluate the effectiveness of the mechanical retention is by the 15 N test described herein.

- b) For a connecting component relying on friction to remain in place and not attached in any way outside of the connection points, the separating force in Newtons shall be greater than 100 times the weight (in kg) of the component, with the force applied gradually near the centre of the component. In this case, a mechanical retaining device is not required.

4.2.3.6 Pluggable terminal bridging connections

These connections are intended to be made one-time only and not connected or disconnected during maintenance or repair. For Level of Protection “eb”, a terminal bridging connector shall have a separating force in Newtons that is greater than 200 times the weight (in kg) of the terminal bridging connector. The force shall be applied gradually near the centre of the terminal bridging connector.

For Level of Protection “ec”, a terminal bridging connector shall have a separating force in Newtons that is greater than 100 times the weight (in kg) of the terminal bridging connector. The force shall be applied gradually near the centre of the terminal bridging connector.

4.2.4 External plug and socket connections for field wiring connection

Plug and socket connections, where the flange plug or socket forms part of the wall of the enclosure, and the mating plug or socket is intended to be inserted externally, shall comply with the supplementary requirements of this sub-clause. The connections of the mating portion, if provided un-terminated, are considered field wiring.

Plugs and sockets for field wiring connections either:

- Between one piece of electrical equipment and another piece of electrical equipment (by means of a cable assembly involving plugs & sockets on both ends or a plug & socket on one end and un-terminated cable on the other), or
- Between the fixed installation and a piece of electrical equipment (by means of a cable assembly involving a socket on the equipment end and un-terminated cable on the fixed installation end),

shall comply with item a), b) or c) as follows:

- a) they shall be interlocked mechanically or electrically, or otherwise designed so that they cannot be separated when the contacts are energized and the contacts cannot be energized when plug and socket are separated;
- b) the equipment marked with the CONNECT / DISCONNECT marking as required by item a) of 9.4, and for Level of Protection “ec”, fixed together; for Level of Protection “eb”, fixed together by means of special fasteners.
- c) Where they cannot be de-energized before connection or disconnection according to b) above because they are connected to a battery, the marking shall state the separation warning required by item j) of [9.4](#).

Provision shall be made for the fixed part of a plug and socket connector to maintain the degree of protection of the enclosure on which it is mounted, even when the movable part has been removed. If the degree of protection is effectively reduced by accumulation of dust or water, provision shall also be made for maintaining an appropriate degree of ingress protection for the plug and/or socket.

4.3 Clearances

Clearances between bare conductive parts at different potentials shall be as given in [Table 2](#) with a minimum value for field wiring connections of 3 mm for Level of Protection “eb” or 1,5 mm for Level of Protection “ec”. Alternatively, for Level of Protection “ec”, clearances for other than field wiring connections shall be permitted to conform to the values given in [Annex H](#).

Spacings at wiring terminals shall be evaluated with and without the conductor to determine the minimum clearance under worst case conditions. Conductor arrangement shall be as specified by the manufacturer.

NOTE 1 The conductor arrangement by the manufacturer includes conductor sizes, conductor stripping dimensions, conductor ferrule usage, maximum screw torque, etc.

NOTE 2 A wiring terminal supplied with the conductor clamping arrangement fully open can present the worst case condition for spacings.

Clearances shall be determined as a function of the working voltage. Where the equipment is intended for more than one rated voltage or for a range of rated voltages, the value of working voltage to be used shall be based on the highest value of rated voltage. In determining the clearances, examples 1 to 11 (inclusive) in [Figure 1](#) illustrate the features to be taken into account and the appropriate clearances.

Unless otherwise required in this standard, the enhanced clearance distances for equipment of Level of Protection “ec” only apply to mains circuits and between isolated circuits. The enhanced clearance distances do not apply to printed wiring board mounted components.

4.4 Creepage distances

4.4.1 The required values of creepage distance are dependent on the working voltage, the resistance to tracking of the electrical insulating material and its surface profile.

Spacings at wiring terminals shall be evaluated with and without the conductor to determine the minimum creepage.

[Table 1](#) gives the grouping of electrical insulating materials according to the comparative tracking index (CTI) determined in accordance with IEC 60112. Inorganic insulating materials, for example glass and ceramics, do not track and need not therefore be subjected to the determination of the CTI. They are conventionally classified in material group I.

The grouping given in [Table 1](#) is applied to insulating parts without ribs or grooves. If there are ribs or grooves in accordance with [4.4.3](#), the minimum permissible creepage distances for working voltages up to 1 100 V shall be based on the next highest material group, for example material group I instead of material group II.

NOTE 1 The material groups are identical with those given in IEC 60664-1.

Transient overvoltages are to be ignored as they do not normally influence tracking phenomena. However, temporary and functional overvoltages may have to be considered, depending upon the duration and frequency of occurrence.

Unless otherwise required in this standard, the enhanced creepage distances for equipment of Level of Protection “ec” only apply to mains circuits and between isolated circuits. The enhanced creepage distances do not apply to printed wiring board mounted components.

NOTE 2 See IEC 60664-1 for additional information.

Table 1 — Tracking resistance of insulating materials

Material group	Comparative tracking index (CTI)
I	$600 \leq \text{CTI}$
II	$400 \leq \text{CTI} < 600$
IIIa	$175 \leq \text{CTI} < 400$
IIIb	$100 \leq \text{CTI} < 175$

4.4.2 Creepage distances between bare conductive parts at different potentials shall be as given in [Table 2](#), with a minimum value for field wiring connections of 3 mm for Level of Protection “eb” or 1,5 mm for Level of Protection “ec”, and shall be determined as a function of the rated voltage specified by the manufacturer of the equipment. Alternatively, for Level of Protection “ec”, creepage distances for other than field wiring connections shall be permitted to conform to the values given in [Annex H](#).

4.4.3 In determining the creepage distance, [Figure 1](#) illustrates the features to be taken into account and the appropriate creepage distance. The value of dimension 'X' is 2,5 mm for Level of Protection “eb” and 1,5 mm for Level of Protection “ec”.

The effects of ribs and grooves may be taken into account provided that:

- a) For Level of Protection “eb”:
 - ribs on the surface are at least 2,5 mm high and of a thickness appropriate to the mechanical strength of the material with a minimum value of 1,0 mm;