

INTERNATIONAL STANDARD

**Explosive atmospheres –
Part 7: Equipment protection by increased safety "e"**





THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2015 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

More than 60 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.



IEC 60079-7

Edition 5.0 2015-06

INTERNATIONAL STANDARD

**Explosive atmospheres –
Part 7: Equipment protection by increased safety "e"**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.260.20

ISBN 978-2-8322-2710-7

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	8
1 Scope.....	14
2 Normative references	15
3 Terms and definitions	17
4 Constructional requirements	21
4.1 Level of Protection	21
4.2 Electrical connections	21
4.2.1 General	21
4.2.2 Field wiring connections	22
4.2.3 Factory connections.....	23
4.2.4 External plug and socket connections for field wiring connection	25
4.3 Clearances	26
4.4 Creepage distances	26
4.5 Printed wiring boards with conformal coating, Level of Protection “ec”	32
4.6 Solid electrical insulating materials	33
4.6.1 Specification.....	33
4.6.2 Long-term thermal stability	33
4.7 Windings.....	34
4.7.1 General	34
4.7.2 Insulated conductors	34
4.7.3 Winding impregnation	34
4.7.4 Conductor dimensions	34
4.7.5 Sensing elements	35
4.8 Temperature limitations	35
4.8.1 General	35
4.8.2 Conductors	35
4.8.3 Insulated windings	36
4.9 Wiring internal to equipment	36
4.10 Degrees of protection provided by enclosures.....	37
4.11 Fasteners	38
5 Supplementary requirements for specific electrical equipment	38
5.1 General.....	38
5.2 Electrical machines.....	38
5.2.1 General	38
5.2.2 Degrees of protection provided by electrical machines, Level of Protection “eb”.....	39
5.2.3 Degrees of protection provided by electrical machines, Level of Protection “ec”.....	39
5.2.4 Connection facilities for external conductors	39
5.2.5 Internal fans	39
5.2.6 Minimum air gap	39
5.2.7 Rotating electrical machines with cage rotors	40
5.2.8 Limiting temperature	42
5.2.9 Machines with permanent magnet rotors.....	45
5.2.10 Stator winding insulation system.....	45
5.2.11 Supplemental winding requirements Level of Protection “eb”	46

5.2.12	Bearing seals and shaft seals	46
5.2.13	Neutral point connections	47
5.3	Luminaires, hand lights, or caplights	47
5.3.1	General	47
5.3.2	Light source.....	48
5.3.3	Minimum distance between lamp and protective cover	49
5.3.4	Electrical spacings.....	49
5.3.5	Lampholders and lamp caps	50
5.3.6	Auxiliaries for Luminaires in Level of Protection “ec”.....	53
5.3.7	Surface temperatures	54
5.3.8	Limiting temperatures	55
5.3.9	Luminaires for tubular fluorescent bi-pin lamps	55
5.3.10	Tests for resistance to impact.....	56
5.4	Analog measuring instruments and instrument transformers	56
5.4.1	General	56
5.4.2	Limiting temperature	56
5.4.3	Short-circuit currents	56
5.4.4	Short time thermal current	57
5.4.5	Measuring instruments supplied by current transformers	57
5.4.6	Moving coils	57
5.4.7	External secondary circuits	57
5.5	Transformers other than instrument transformers.....	57
5.6	Supplementary requirements for equipment incorporating cells and batteries.....	58
5.6.1	Type of cells and batteries.....	58
5.6.2	Requirements for cells and batteries ≤ 25 Ah.....	59
5.6.3	Requirements for valve-regulated or vented cells or batteries >25 Ah	62
5.6.4	Charging of cells and batteries	65
5.7	General purpose connection and junction boxes	66
5.8	Resistance heating equipment (other than trace heating systems)	66
5.8.1	General	66
5.8.2	Heating resistors	66
5.8.3	Temperature coefficient	67
5.8.4	Insulating material	67
5.8.5	Cold-start current.....	67
5.8.6	Electrical safety device	67
5.8.7	Electrically conductive covering	67
5.8.8	Exclusion of explosive atmosphere	68
5.8.9	Conductor cross-section	68
5.8.10	Limiting temperature	68
5.8.11	Safety device.....	68
5.9	Supplementary requirements for fuses	69
5.9.1	General	69
5.9.2	Temperature class of equipment.....	70
5.9.3	Fuse mounting.....	70
5.9.4	Fuse enclosures	70
5.9.5	Replacement fuse identification	70
5.10	Other electrical equipment	70
6	Type verifications and type tests.....	70
6.1	Dielectric strength.....	70

6.2	Rotating electrical machines	71
6.2.1	Determination of starting current ratio I_A/I_N and the time t_E	71
6.2.2	Mounting of machine for test.....	71
6.2.3	Additional tests for machines	71
6.2.4	Overspeed test of cemented magnets	73
6.3	Luminaires	73
6.3.1	Battery operated luminaires	73
6.3.2	Impact and drop tests	73
6.3.3	Mechanical tests for screw lampholders other than E10.....	74
6.3.4	Abnormal operation of luminaires	75
6.3.5	Sulphur dioxide test for Level of Protection “eb” for the connection of bi-pin lamp caps to lampholders	76
6.3.6	Vibration test for Level of Protection “eb” for luminaires with bi-pin lamps	77
6.3.7	Test for wiring of luminaires subject to high-voltage impulses from ignitors	78
6.3.8	Tests for electronic starters for tubular fluorescent lamps and for ignitors in Level of Protection “ec” for discharge lamps.....	78
6.3.9	Test for starter holders for luminaires in Level of Protection “ec”	79
6.4	Measuring instruments and instrument transformers	79
6.5	Transformers other than instrument transformers.....	80
6.6	Verification and tests for cells and batteries of Level of Protection “eb”	80
6.6.1	General	80
6.6.2	Insulation resistance.....	80
6.6.3	Mechanical shock test	80
6.6.4	Test for ventilation of Level of Protection “eb” battery container.....	81
6.7	Verification and tests for cells and batteries of Level of Protection “ec”	82
6.7.1	General	82
6.7.2	Insulation resistance.....	82
6.7.3	Mechanical shock test	82
6.7.4	Test for ventilation of Level of Protection “ec” battery container.....	82
6.8	General purpose connection and junction boxes	83
6.8.1	General	83
6.8.2	Maximum dissipated power method	83
6.8.3	Defined arrangement method.....	83
6.9	Resistance heating equipment	83
6.10	Terminal insulating material tests.....	84
7	Routine verifications and routine tests	85
7.1	Dielectric tests	85
7.2	Dielectric tests for batteries	86
7.3	Inter-turn overvoltage tests	86
8	Ex Component certificates	86
8.1	General.....	86
8.2	Terminals.....	86
9	Marking and instructions.....	87
9.1	General marking	87
9.2	Ex Component enclosures	88
9.3	Instructions for use	88
9.3.1	Battery operated equipment.....	88

9.3.2	Terminals	88
9.3.3	Luminaires.....	88
9.3.4	Machines.....	89
9.4	Warning markings	89
10	Documentation	90
Annex A (normative) Temperature determination of electrical machines – Methods of test and of calculation.....		91
A.1	General.....	91
A.2	Determination of maximum service temperatures	91
A.2.1	Rotor temperature – normal operation	91
A.2.2	Winding temperature – normal operation	91
A.3	Determination of maximum surface temperatures.....	92
A.3.1	General	92
A.3.2	Locked rotor tests	92
A.4	Optional calculation of maximum surface temperature	93
A.4.1	General	93
A.4.2	Rotor temperature	93
A.4.3	Stator temperature.....	93
A.5	Determination of t_E time	93
A.6	Arduous starting conditions.....	94
A.7	Motors operated with a converter	94
Annex B (normative) Type tests for specific forms of resistance heating devices or resistance heating units (other than trace heater)		95
B.1	Resistance heating devices subjected to mechanical stresses	95
B.2	Resistance heating devices or units intended for immersion.....	95
B.3	Resistance heating devices or units having hygroscopic insulating material.....	95
B.4	Verification of limiting temperature of resistance heating devices (other than trace heaters)	95
B.4.1	General	95
B.4.2	Safety devices	95
B.4.3	Resistance heating unit of stabilized design.....	96
B.4.4	Heating device with temperature self-limiting characteristic	96
Annex C (informative) Cage motors – Thermal protection in service.....		97
Annex D (informative) Resistance heating devices and units – Additional electrical protection		98
D.1	Objective	98
D.2	Method of protection	98
Annex E (informative) Combinations of terminals and conductors for general purpose connection and junction boxes.....		99
E.1	General.....	99
E.2	Maximum dissipated power method.....	99
E.3	Defined arrangement method.....	99
Annex F (normative) Dimensions of copper conductors.....		102
Annex G (normative) Test procedure for T5 (only 8 W), T8, T10 and T12 lamps.....		103
G.1	Asymmetric pulse test.....	103
G.1.1	General	103
G.1.2	Test procedure	103
G.2	Asymmetric power test.....	104
G.2.1	General	104

G.2.2	Test procedure	105
Annex H (normative)	Alternative separation distances for Level of Protection “ec” equipment under controlled environments.....	108
H.1	General.....	108
H.2	Specific Conditions of Use	108
H.3	Control of pollution access	109
H.4	Voltage limitation	109
H.5	Control of overvoltages and transient protection	109
H.6	Alternative separation distances	109
Annex I (informative)	Application, installation, and testing considerations for Level of Protection “ec” asynchronous machines.....	111
I.1	Surface temperature	111
I.2	Starting.....	111
I.3	Rated voltage and surface discharges	112
Annex J (informative)	Luminaires incorporating LEDs	113
J.1	LEDs for EPL Gb	113
J.2	LEDs for EPL Gc.....	113
Bibliography.....		114
Figure 1 –	Determination of creepage distances and clearances	32
Figure 2 –	Minimum values of the time t_E (in seconds) of motors in relation to the starting current ratio I_A/I_N	43
Figure 3 –	Arrangement for the luminaire vibration test	77
Figure A.1 –	Diagram illustrating the determination of time t_E	94
Figure E.1 –	Example of defined terminal/conductor arrangement table	101
Figure G.1 –	Asymmetric pulse test circuit	104
Figure G.2 –	Asymmetric power detection circuit.....	106
Figure G.3 –	Flow Chart – Asymmetric power Test for T8, T10, T12 and T5 (8 W lamps)	107
Table 1 –	Tracking resistance of insulating materials	27
Table 2 –	Minimum Creepage distances, clearances and separations	28
Table 3 –	Conditions for the determination of maximum surface temperature	35
Table 4 –	Maximum temperatures for insulated windings	36
Table 5 –	Potential air gap sparking risk assessment for cage rotor ignition risk factors.....	42
Table 6 –	Stator insulation system tests of Level of Protection “ec” machines	46
Table 7 –	Assumed voltage of neutral points.....	47
Table 8 –	Minimum distance between lamp and protective cover	49
Table 9 –	Creepage distances and clearances at peak values of pulse voltages greater than 1,5 kV	50
Table 10 –	Creepage distances and clearances for screw lampholder and lamp cap	51
Table 11 –	Resistance to the effect of short-circuit currents	57
Table 12 –	Types and use of cells and batteries	59
Table 13 –	Explosion test mixtures	72
Table 14 –	Tests for resistance to impact.....	74
Table 15 –	Insertion torque and minimum removal torque	74

Table 16 – Power dissipation of cathodes of lamps supplied by electronic ballasts	76
Table 17 – Value for pull-out tests	85
Table 18 – Creepage distances and clearances for screw lamp caps	89
Table 19 – Text of warning markings.....	89
Table F.1 – Standard cross-sections of copper conductors	102
Table H.1 – Alternative separation distances for equipment under controlled environments	110

INTERNATIONAL ELECTROTECHNICAL COMMISSION

EXPLOSIVE ATMOSPHERES –**Part 7: Equipment protection
by increased safety "e"**

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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 Clarification of applicability Notes added to address short circuits and short-term thermal excursions	1	X		
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	
Clarified applicability to handlights and caplights	5.3	X		

for “nA” to “ec”		Type		
Explanation of the significance of the changes	Clause	Minor and editorial changes	Extension	Major technical changes
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.

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

FDIS	Report on voting
31/1182/FDIS	31/1194/RVD

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

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

A list of all parts of IEC 60079 series, under the general title *Explosive atmospheres*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC 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.

A bilingual version of this publication may be issued at a later date.

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.