

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

---

**Explosive atmospheres –  
Part 0: Equipment – General requirements**

**Atmosphères explosives –  
Partie 0: Matériel – Exigences générales**



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2011 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.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland  
Email: [inmail@iec.ch](mailto:inmail@iec.ch)  
Web: [www.iec.ch](http://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.

- Catalogue of IEC publications: [www.iec.ch/searchpub](http://www.iec.ch/searchpub)

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 It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: [www.iec.ch/online\\_news/justpub](http://www.iec.ch/online_news/justpub)

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

- Electropedia: [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: [www.iec.ch/webstore/custserv](http://www.iec.ch/webstore/custserv)

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: [csc@iec.ch](mailto:csc@iec.ch)  
Tel.: +41 22 919 02 11  
Fax: +41 22 919 03 00

### A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des normes internationales pour toute ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

### A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

- Catalogue des publications de la CEI: [www.iec.ch/searchpub/cur\\_fut-f.htm](http://www.iec.ch/searchpub/cur_fut-f.htm)

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,...). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: [www.iec.ch/online\\_news/justpub](http://www.iec.ch/online_news/justpub)

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: [www.electropedia.org](http://www.electropedia.org)

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: [www.iec.ch/webstore/custserv/custserv\\_entry-f.htm](http://www.iec.ch/webstore/custserv/custserv_entry-f.htm)

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:

Email: [csc@iec.ch](mailto:csc@iec.ch)  
Tél.: +41 22 919 02 11  
Fax: +41 22 919 03 00

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

---

**Explosive atmospheres –  
Part 0: Equipment – General requirements**

**Atmosphères explosives –  
Partie 0: Matériel – Exigences générales**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

PRICE CODE **XD**  
CODE PRIX

ICS 29.260.20

ISBN 978-2-88912-519-7

## CONTENTS

FOREWORD.....	7
1 Scope.....	10
2 Normative references.....	11
3 Terms and definitions.....	14
4 Equipment grouping.....	26
4.1 Group I.....	26
4.2 Group II.....	26
4.3 Group III.....	26
4.4 Equipment for a particular explosive atmosphere.....	27
5 Temperatures.....	27
5.1 Environmental influences.....	27
5.1.1 Ambient temperature.....	27
5.1.2 External source of heating or cooling.....	27
5.2 Service temperature.....	27
5.3 Maximum surface temperature.....	28
5.3.1 Determination of maximum surface temperature.....	28
5.3.2 Limitation of maximum surface temperature.....	28
5.3.3 Small component temperature for Group I or Group II electrical equipment.....	29
6 Requirements for all electrical equipment.....	30
6.1 General.....	30
6.2 Mechanical strength of equipment.....	30
6.3 Opening times.....	30
6.4 Circulating currents in enclosure (e.g. of large electrical machines).....	31
6.5 Gasket retention.....	31
6.6 Electromagnetic and ultrasonic energy radiating equipment.....	31
6.6.1 Radio frequency sources.....	31
6.6.2 Lasers or other continuous wave sources.....	32
6.6.3 Ultrasonic sources.....	33
7 Non-metallic enclosures and non-metallic parts of enclosures.....	33
7.1 General.....	33
7.1.1 Applicability.....	33
7.1.2 Specification of materials.....	33
7.2 Thermal endurance.....	34
7.2.1 Tests for thermal endurance.....	34
7.2.2 Material selection.....	34
7.2.3 Alternative qualification of elastomeric sealing O-rings.....	34
7.3 Resistance to light.....	34
7.4 Electrostatic charges on external non-metallic materials.....	35
7.4.1 Applicability.....	35
7.4.2 Avoidance of a build-up of electrostatic charge on Group I or Group II electrical equipment.....	35
7.4.3 Avoidance of a build-up of electrostatic charge on equipment for Group III.....	37
7.5 Accessible metal parts.....	37
8 Metallic enclosures and metallic parts of enclosures.....	38

8.1	Material composition .....	38
8.2	Group I.....	38
8.3	Group II.....	38
8.4	Group III.....	39
9	Fasteners .....	39
9.1	General .....	39
9.2	Special fasteners.....	39
9.3	Holes for special fasteners .....	40
9.3.1	Thread engagement .....	40
9.3.2	Tolerance and clearance .....	40
9.3.3	Hexagon socket set screws .....	41
10	Interlocking devices.....	41
11	Bushings .....	41
12	Materials used for cementing.....	41
13	Ex Components .....	42
13.1	General .....	42
13.2	Mounting .....	42
13.3	Internal mounting .....	42
13.4	External mounting .....	42
13.5	Ex Component certificate .....	42
14	Connection facilities and termination compartments .....	43
14.1	General .....	43
14.2	Termination compartment.....	43
14.3	Type of protection .....	43
14.4	Creepage and clearance .....	43
15	Connection facilities for earthing or bonding conductors .....	43
15.1	Equipment requiring earthing .....	43
15.1.1	Internal.....	43
15.1.2	External.....	43
15.2	Equipment not requiring earthing.....	43
15.3	Size of conductor connection.....	44
15.4	Protection against corrosion .....	44
15.5	Secureness of electrical connections.....	44
16	Entries into enclosures .....	44
16.1	General .....	44
16.2	Identification of entries .....	44
16.3	Cable glands .....	45
16.4	Blanking elements .....	45
16.5	Thread adapters .....	45
16.6	Temperature at branching point and entry point.....	45
16.7	Electrostatic charges of cable sheaths .....	46
17	Supplementary requirements for rotating machines .....	46
17.1	Ventilation .....	46
17.1.1	Ventilation openings .....	46
17.1.2	Materials for external fans .....	47
17.1.3	Cooling fans of rotating machines.....	47
17.1.4	Auxiliary motor cooling fans.....	47
17.1.5	Ventilating fans.....	47

17.2	Bearings.....	48
18	Supplementary requirements for switchgear .....	48
18.1	Flammable dielectric .....	48
18.2	Disconnectors .....	49
18.3	Group I – Provisions for locking.....	49
18.4	Doors and covers .....	49
19	Supplementary requirements for fuses .....	49
20	Supplementary requirements for plugs, socket outlets and connectors .....	50
20.1	General.....	50
20.2	Explosive gas atmospheres .....	50
20.3	Explosive dust atmospheres .....	50
20.4	Energized plugs .....	50
21	Supplementary requirements for luminaires .....	50
21.1	General.....	50
21.2	Covers for luminaires of EPL Mb, EPL Gb, or EPL Db .....	51
21.3	Covers for luminaires of EPL Gc or EPL Dc.....	51
21.4	Sodium lamps .....	51
22	Supplementary requirements for caplights and handlights .....	52
22.1	Group I caplights.....	52
22.2	Group II and Group III caplights and handlights .....	52
23	Equipment incorporating cells and batteries .....	52
23.1	General .....	52
23.2	Batteries .....	52
23.3	Cell types .....	52
23.4	Cells in a battery .....	54
23.5	Ratings of batteries .....	54
23.6	Interchangeability .....	54
23.7	Charging of primary batteries .....	54
23.8	Leakage .....	54
23.9	Connections .....	54
23.10	Orientation.....	54
23.11	Replacement of cells or batteries.....	54
23.12	Replaceable battery pack .....	55
24	Documentation .....	55
25	Compliance of prototype or sample with documents .....	55
26	Type tests .....	55
26.1	General.....	55
26.2	Test configuration.....	55
26.3	Tests in explosive test mixtures.....	55
26.4	Tests of enclosures .....	56
26.4.1	Order of tests .....	56
26.4.2	Resistance to impact .....	57
26.4.3	Drop test .....	59
26.4.4	Acceptance criteria.....	59
26.4.5	Degree of protection (IP) by enclosures.....	59
26.5	Thermal tests .....	60
26.5.1	Temperature measurement.....	60
26.5.2	Thermal shock test .....	61

26.5.3	Small component ignition test (Group I and Group II).....	62
26.6	Torque test for bushings.....	62
26.6.1	Test procedure.....	62
26.6.2	Acceptance criteria.....	63
26.7	Non-metallic enclosures or non-metallic parts of enclosures.....	63
26.7.1	General.....	63
26.7.2	Test temperatures.....	63
26.8	Thermal endurance to heat.....	63
26.9	Thermal endurance to cold.....	64
26.10	Resistance to light.....	64
26.10.1	Test procedure.....	64
26.10.2	Acceptance criteria.....	65
26.11	Resistance to chemical agents for Group I electrical equipment.....	65
26.12	Earth continuity.....	65
26.13	Surface resistance test of parts of enclosures of non-metallic materials.....	67
26.14	Measurement of capacitance.....	68
26.14.1	General.....	68
26.14.2	Test procedure.....	68
26.15	Verification of ratings of ventilating fans.....	69
26.16	Alternative qualification of elastomeric sealing O-rings.....	69
27	Routine tests.....	69
28	Manufacturer's responsibility.....	70
28.1	Conformity with the documentation.....	70
28.2	Certificate.....	70
28.3	Responsibility for marking.....	70
29	Marking.....	70
29.1	Applicability.....	70
29.2	Location.....	70
29.3	General.....	70
29.4	Ex marking for explosive gas atmospheres.....	71
29.5	Ex marking for explosive dust atmospheres.....	73
29.6	Combined types (or levels) of protection.....	74
29.7	Multiple types of protection.....	74
29.8	Ga equipment using two independent Gb types (or levels) of protection.....	75
29.9	Ex Components.....	75
29.10	Small equipment and small Ex Components.....	75
29.11	Extremely small equipment and extremely small Ex Components.....	76
29.12	Warning markings.....	76
29.13	Alternate marking of equipment protection levels (EPLs).....	76
29.13.1	Alternate marking of type of protection for explosive gas atmospheres.....	77
29.13.2	Alternate marking of type of protection for explosive dust atmospheres.....	77
29.14	Cells and batteries.....	77
29.15	Converter-fed electrical machines.....	78
29.16	Examples of marking.....	78
30	Instructions.....	81
30.1	General.....	81
30.2	Cells and batteries.....	81

30.3 Electrical machines .....	82
30.4 Ventilating fans .....	82
Annex A (normative) Supplementary requirements for cable glands .....	83
Annex B (normative) Requirements for Ex Components .....	90
Annex C (informative) Example of rig for resistance to impact test .....	92
Annex D (informative) Motors supplied by converters .....	93
Annex E (informative) Temperature rise testing of electric machines .....	94
Annex F (informative) Guideline flowchart for tests of non-metallic enclosures or non-metallic parts of enclosures (26.4) .....	96
Bibliography .....	97
Figure 1 – Tolerances and clearance for threaded fasteners .....	40
Figure 2 – Contact surface under head of fastener with a reduced shank .....	41
Figure 3 – Illustration of entry points and branching points .....	46
Figure 4 – Assembly of test sample for earth-continuity test .....	67
Figure 5 – Test piece with painted electrodes .....	68
Figure 6 – Compression set of an O-ring .....	69
Figure A.1 – Illustration of the terms used for cable glands .....	84
Figure A.2 – Rounded edge of the point of entry of the flexible cable .....	85
Figure C.1 – Example of rig for resistance to impact test .....	92
Figure F.1 – Non-metallic enclosures or non-metallic parts of enclosures .....	96
Table 1 – Ambient temperatures in service and additional marking .....	27
Table 2 – Classification of maximum surface temperatures for Group II electrical equipment .....	28
Table 3a – Assessment of temperature classification according to component size at 40 °C ambient temperature .....	29
Table 3b – Assessment of temperature classification Component surface area $\geq 20$ mm <sup>2</sup> Variation in maximum power dissipation with ambient temperature .....	29
Table 4 – Radio frequency power thresholds .....	32
Table 5 – Radio-frequency energy thresholds .....	32
Table 6 – Limitation of surface areas .....	36
Table 7 – Maximum diameter or width .....	36
Table 8 – Limitation of thickness of non-metallic layer .....	37
Table 9 – Maximum capacitance of unearthed metal parts .....	38
Table 10 – Minimum cross-sectional area of PE conductors .....	44
Table 11 – Primary cells .....	53
Table 12 – Secondary cells .....	53
Table 13 – Tests for resistance to impact .....	58
Table 14 – Torque to be applied to the stem of bushing used for connection facilities .....	63
Table 15 – Thermal endurance test .....	64
Table 16 – Text of warning markings .....	76
Table B.1 – Clauses with which Ex Components shall comply .....	90

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**EXPLOSIVE ATMOSPHERES –****Part 0: Equipment – General requirements**

## 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 60079-0 has been prepared by IEC technical committee 31: Equipment for explosive atmospheres.

This sixth edition cancels and replaces the fifth edition, published in 2007, and constitutes a full technical revision.

The significant changes with respect to the previous edition are listed below:

- Relocation of definitions for energy limitation parameters to IEC 60079-11
- Addition of note to clarify that the non-metallic "enclosure" requirements are applied to other than "enclosures" by some of the subparts
- Expansion of material specification data for plastics and elastomers, including UV resistance
- Addition of alternative qualification for O-rings
- Addition of alternative criteria for surface resistance

- Addition of breakdown voltage limit for non-metallic layers applied to metallic enclosures
- Expansion of “X” marking options for non-metallic enclosure materials not meeting basic electrostatic requirements
- Clarification that non-metallic enclosure requirements also apply to painted or coated metal enclosures
- Clarification of test to determine capacitance of accessible metal parts with reduction in acceptable capacitance
- Addition of limits on zirconium content for Group III and Group II (Gb only) enclosures
- Introduction of “X” marking for Group III enclosures not complying with basic material requirements, similar to that existing for Group II
- Addition of button-head cap screws to permitted “Special Fasteners”
- Reference for protective earthing (PE) requirements for electrical machines to IEC 60034-1
- Clarification of terminology for cable glands, blanking elements, and thread adapters
- Addition of requirements for ventilating fans
- Addition of alternative construction for disconnectors
- Removal of voltage limits on plugs and sockets
- Addition of test requirements for arc-quenching test on plugs and sockets
- Update of cell and battery information to reflect latest standards
- Revision to impact test of glass parts
- Revision to impact test procedure to address “bounce” of impact head
- Clarification of the test requirements for “service” and “surface” temperature
- Addition of temperature rise tests for converter-fed motors
- Addition of alternative test method for the main endurance
- Removal of “charging test” and addition of note providing guidance
- Clarification of test for the measurement of capacitance
- Addition of a “Schedule of Limitations” to certificates for Ex Components
- Clarification of the marking for multiple temperature classes
- Addition of marking for converter-fed motors
- Removal of IP marking for Group III
- Addition of specific instructions for electrical machines
- Addition of specific instructions for ventilating fans
- Update of informative Annex D on converter-fed motors
- Update to informative Annex E on temperature testing of motors
- Addition of informative Annex F, flowchart for testing of non-metallic enclosures and non-metallic parts of enclosures

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

FDIS	Report on voting
31/922/FDIS	31/939/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 the IEC 60079 series, under the general title *Explosive atmospheres*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of a new edition.

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.

## EXPLOSIVE ATMOSPHERES –

### Part 0: Equipment – General requirements

#### 1 Scope

This part of IEC 60079 specifies the general requirements for construction, testing and marking of electrical equipment and Ex Components intended for use in explosive atmospheres.

The standard atmospheric conditions (relating to the explosion characteristics of the atmosphere) under which it may be assumed that electrical equipment can be operated are:

- temperature  $-20\text{ °C}$  to  $+60\text{ °C}$ ;
- pressure 80 kPa (0,8 bar) to 110 kPa (1,1 bar); and
- air with normal oxygen content, typically 21 % v/v.

This standard and other standards supplementing this standard specify additional test requirements for equipment operating outside the standard temperature range, but further additional consideration and additional testing may be required for equipment operating outside the standard atmospheric pressure range and standard oxygen content, particularly with respect to types of protection that depend on quenching of a flame such as 'flameproof enclosure "d"' (IEC 60079-1) or limitation of energy, 'intrinsic safety "i"' (IEC 60079-11).

NOTE 1 Although the standard atmospheric conditions above give a temperature range for the atmosphere of  $-20\text{ °C}$  to  $+60\text{ °C}$ , the normal ambient temperature range for the equipment is  $-20\text{ °C}$  to  $+40\text{ °C}$ , unless otherwise specified and marked. See 5.1.1. It is considered that  $-20\text{ °C}$  to  $+40\text{ °C}$  is appropriate for most equipment and that to manufacture all equipment to be suitable for a standard atmosphere upper ambient temperature of  $+60\text{ °C}$  would place unnecessary design constraints.

NOTE 2 Requirements given in this standard result from an ignition hazard assessment made on electrical equipment. The ignition sources taken into account are those found associated with this type of equipment, such as hot surfaces, mechanically generated sparks, mechanical impacts resulting in thermite reactions, electrical arcing and static electric discharge in normal industrial environments.

NOTE 3 It is acknowledged that, with developments in technology, it may be possible to achieve the objectives of the IEC 60079 series of standards in respect of explosion prevention by methods that are not yet fully defined. Where a manufacturer wishes to take advantage of such developments, this International Standard, as well as other standards in the IEC 60079 series, may be applied in part. It is intended that the manufacturer prepare documentation that clearly defines how the IEC 60079 series of standards has been applied, together with a full explanation of the additional techniques employed. The designation "Ex s" has been reserved to indicate special protection. A standard for special protection "s", IEC 60079-33, is in preparation.

NOTE 4 Where an explosive gas atmosphere and a combustible dust atmosphere are, or may be, present at the same time, the simultaneous presence of both should be considered and may require additional protective measures.

This standard does not specify requirements for safety, other than those directly related to the explosion risk. Ignition sources like adiabatic compression, shock waves, exothermic chemical reaction, self ignition of dust, naked flames and hot gases/liquids, are not addressed by this standard.

NOTE 5 Such equipment should be subjected to a hazard analysis that identifies and lists all of the potential sources of ignition by the electrical equipment and the measures to be applied to prevent them becoming effective.

This standard is supplemented or modified by the following standards concerning specific types of protection:

- IEC 60079-1: Gas – Flameproof enclosures "d";
- IEC 60079-2: Gas – Pressurized enclosures "p";