

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

---

**Explosive atmospheres –  
Part 18: Equipment protection by encapsulation "m"**

**Atmosphères explosives –  
Partie 18: Protection de l'appareil par encapsulage "m"**



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2025 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 l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

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

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[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 corrigendum or an amendment might have been published.

#### IEC publications search -

[webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

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 It also gives information on projects, replaced and withdrawn publications.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](http://webstore.iec.ch/justpublished)

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

#### IEC Customer Service Centre - [webstore.iec.ch/csc](http://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: [sales@iec.ch](mailto:sales@iec.ch).

#### IEC Products & Services Portal - [products.iec.ch](http://products.iec.ch)

Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

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

The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

### A propos de l'IEC

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

### A propos des publications IEC

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

#### Recherche de publications IEC -

[webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

#### Service Clients - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: [sales@iec.ch](mailto:sales@iec.ch).

#### IEC Products & Services Portal - [products.iec.ch](http://products.iec.ch)

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications, symboles graphiques et le glossaire. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

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

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 500 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 25 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

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

**Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

## CONTENTS

FOREWORD.....	5
1 Scope.....	9
2 Normative references .....	9
3 Terms and definitions .....	10
4 General requirements .....	11
4.1 Level of Protection (Equipment Protection Level (EPL)) .....	11
4.2 Rated voltage and maximum prospective current .....	11
4.3 Additional requirements for Levels of Protection "ma" and "mb" .....	11
5 Requirements for compounds .....	11
5.1 General.....	11
5.2 Specification .....	12
5.3 Properties of the compound .....	12
5.3.1 Water absorption .....	12
5.3.2 Dielectric strength.....	12
6 Temperatures .....	12
6.1 General.....	12
6.2 Maximum surface temperature .....	13
6.3 Service temperature of the compound.....	13
6.4 Temperature limitation of the "m" equipment.....	13
7 Constructional requirements .....	13
7.1 General.....	13
7.2 Determination of faults .....	14
7.2.1 Fault examination .....	14
7.2.2 Components considered as not subject to fail .....	14
7.2.3 Isolating components.....	15
7.2.4 Infallible separation distances.....	15
7.3 Free space in the encapsulation .....	16
7.3.1 Group III "m" Equipment .....	16
7.3.2 Group I and Group II "m" Equipment.....	17
7.4 Thickness of the compound.....	18
7.4.1 "m" Equipment.....	18
7.4.2 Windings for electrical machines.....	20
7.4.3 Rigid, multi-layer printed wiring boards with through connections .....	20
7.5 Switching contacts .....	21
7.5.1 General .....	21
7.5.2 Level of Protection "ma" .....	21
7.5.3 Level of Protection "mb" .....	21
7.5.4 Level of Protection "mc".....	21
7.6 External connections.....	22
7.6.1 General .....	22
7.7 Protection of bare live parts .....	22
7.8 Cells and batteries .....	22
7.8.1 General .....	22
7.8.2 Prevention of gassing .....	22
7.8.3 Protection against inadmissible temperatures and damage to the cells or batteries .....	22

7.8.4	Reverse current .....	23
7.8.5	Current limitation .....	23
7.8.6	Protection against the polarity inversion and deep discharge of the cells .....	23
7.8.7	Charging of cells or batteries .....	24
7.8.8	Requirements for safety devices for cells or batteries .....	24
7.9	Protective devices .....	24
7.9.1	General .....	24
7.9.2	Electrical protective devices .....	25
7.9.3	Thermal protective devices .....	26
7.9.4	Built-in protective devices .....	26
8	Type tests .....	27
8.1	Tests on the compound .....	27
8.1.1	Water absorption test .....	27
8.1.2	Dielectric strength test .....	27
8.2	Tests on the apparatus .....	27
8.2.1	Test sequence .....	27
8.2.2	Maximum temperature .....	27
8.2.3	Thermal endurance test .....	27
8.2.4	Dielectric strength test .....	28
8.2.5	Cable pull test .....	29
8.2.6	Pressure test for Group I and Group II "m" Equipment .....	29
8.2.7	Test for resettable thermal protective device .....	30
8.2.8	Sealing test for built-in protective devices .....	30
9	Routine verifications and tests .....	31
9.1	Visual inspections .....	31
9.2	Dielectric strength test .....	31
10	Marking .....	32
Annex A (informative)	Basic requirements for compounds for "m" Equipment .....	33
Annex B (informative)	Allocation of test samples .....	34
Annex C (normative)	Dielectric strength test between circuits and environment .....	35
C.1	General .....	35
C.2	Batch test procedure .....	35
Bibliography	.....	36
Figure 1	– Dimensional key for thickness through the compound .....	19
Figure 2	– Minimum distances for multi-layer printed wiring boards .....	21
Figure 3	– Fitting of blocking diodes .....	23
Figure A.1	– Basic requirements for compounds for "m" Equipment .....	33
Table 1	– Distances through the compound .....	16
Table 2	– Minimum thickness of compound adjacent to free space for Group III "m" Equipment .....	17
Table 3	– Minimum thickness of compound adjacent to free space for Group I and Group II "m" Equipment .....	18
Table 4	– Thickness of the compound .....	19
Table 5	– Minimum distances for multi-layer printed wiring boards .....	20
Table 6	– Test pressure .....	30

Table B.1 – Allocation of test samples ..... 34

This document is a preview generated by EVS

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## EXPLOSIVE ATMOSPHERES –

## Part 18: Equipment protection by encapsulation "m"

## 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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 60079-18 has been prepared by IEC technical committee 31: Equipment for explosive atmospheres. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 2014 and Amendment 1:2017. This edition constitutes a technical revision.

This International Standard is to be used in conjunction with IEC 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*.

Users of this document are advised that interpretation sheets clarifying the interpretation of this document can be published. Interpretation sheets are available from the IEC webstore and can be found in the "history" tab of the page for each document.

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

Explanation of the significance of the changes	Clause	Type		
		Minor and editorial changes	Extension	Major technical changes
Specification has been extended for clarification. Curing conditions have been added	5.2b)			C1
Dielectric strength test according to ANSI/UL 746A has been added as alternative	5.3.2		X	
Restructure of Clause 6	6	X		
Deletion of the additional protective measures as they are given in IEC 60079-0	7.1	X		
For the Level of Protection "mc" faults need to be considered regarding the separation distances	7.2.1			C1
The NOTE was changed to an EXAMPLE for clarification of track failures	7.2.1	X		
Intermediate failure conditions for components are not considered	7.2.1	X		
Clarification made about faults	7.2.1	X		
Another possibility for the construction of transformer according to IEC 60079-7 EPL "eb" added	7.2.3		X	
Rating of component shall not be exceeded was added as clarification	7.5.1			C1
Additional enclosure changed to "arc chamber" housing	7.5.1, 7.5.2, 7.5.3	X		
Consideration of fault conditions has been added	7.5.2			C1
Additional requirements for "ma" Equipment deleted	Former 7.6.2	X		
NOTE 2 added for protection of bare live parts	7.7	X		
Note 1 and Note 2 have been changed to normative text for clarification	7.9.1	X		
Requirement regarding the thermal coupling moved from 7.9.3 to 7.9.1 as this is applicable for all temperature monitoring devices	7.9.1	X		
The surface temperature determination for EPL Da has been deleted, because this is given in IEC 60079-0	8.2.2	X		
Acceptance criteria for the Dielectric strength test aligned with the TC 31 Good Working Practice	8.2.4.2	X		

**Explanation of the types of significant changes:****A) Definitions**

- 1 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.

- 2 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.

- 3 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 item B) below.

NOTE These changes represent current technological knowledge. However, these changes should not normally have an influence on equipment already placed on the market.

**B) Information about the background of 'Major technical changes'**

- C1 It is recognized that the new requirements were, in many cases, already applied. The change is to ensure that they are uniformly and consistently applied.

The text of this International Standard is based on the following documents:

Draft	Report on voting
31/1858/FDIS	31/870/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

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

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under [webstore.iec.ch](http://webstore.iec.ch) in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

This document is a preview generated by EVS

## EXPLOSIVE ATMOSPHERES –

### Part 18: Equipment protection by encapsulation "m"

#### 1 Scope

This part of IEC 60079 gives the specific requirements for the construction, testing and marking of electrical Ex Equipment, parts of electrical Ex Equipment and Ex Components with the Type of Protection encapsulation "m" (hereinafter referred to as "m" Equipment) intended for use in explosive gas atmospheres or explosive dust atmospheres.

For Levels of Protection "mb" and "mc", this document applies where the rated voltage does not exceed 11 kV AC<sub>RMS</sub> or DC.

For Level of Protection "ma", this document applies where the rated voltage does not exceed 1 kV AC<sub>RMS</sub> or DC.

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

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

#### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

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

IEC 60079-15, *Explosive atmospheres – Part 15: Equipment protection by type of protection "n"*

IEC 60127 (all parts), *Miniature fuses*

IEC 60243-1, *Electric strength of insulating materials – Test methods – Part 1: Tests at power frequencies*

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

IEC 60730-2-9, *Automatic electrical controls – Part 2-9: Particular requirements for temperature sensing controls*

IEC 60738-1, *Thermistors – Directly heated positive temperature coefficient – Part 1: Generic specification*

IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61558-1, *Safety of transformers, reactors, power supply units and combinations thereof – Part 1: General requirements and tests*

IEC 61558-2-6, *Safety of transformers, reactors, power supply units and combinations thereof – Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers for general applications*

IEC 62326-4-1, *Printed boards – Part 4: Rigid multilayer printed boards with interlayer connections – Sectional specification – Section 1: Capability detail specification – Performance levels A, B and C*

ANSI/UL 248 (all parts), *Standard for low-voltage fuses*

ANSI/UL 746A, *Polymeric Materials – Short Term Property Evaluations*

ANSI/UL 796, *Printed-Wiring Boards*

IPC-A-600, *Acceptability of Printed Boards*

IPC-6012, *Qualification and Performance Specification for Rigid Printed Boards*

### 3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

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

#### 3.1 encapsulation "m"

Type of Protection whereby parts that are capable of igniting an explosive atmosphere by either sparking or heating are fully enclosed in such a way as to avoid ignition of a dust layer or explosive atmosphere under operating or installation conditions

#### 3.2 free surface

compound surface exposed to the explosive atmospheres and/or dust layers

Note 1 to entry: Unless a compound surface is in contact with and covered by a non-metallic or metallic enclosure, the compound surface is a free surface.

#### 3.3 switching contact

mechanical contact, designed to make and break an electrical circuit