IEC/IEEE 60079-30-1

Edition 2.0 2025-09

INTERNATIONAL STANDARD

Explosive atmospheres -
Part 30-1: Electrical resistance trace heating - General and testing requirements

ICS 29.260.20

ISBN 978-2-8327-0629-9

IEC/IEEE 60079-30-1:2025-09(en)

THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2025 IEC, Geneva, Switzerland
Copyright © 2025 IEEE

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 being secured. Requests for permission to reproduce should be addressed to either IEC at the address below or IEC's member National Committee in the country of the requester or from IEEE.

IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland
Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue
New York, NY 10016-5997
United States of America
stds.ipr@ieee.org
www.ieee.org

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 the IEEE
IEEE is the world's largest professional association dedicated to advancing technological innovation and excellence for the benefit of humanity. IEEE and its members inspire a global community through its highly cited publications, conferences, technology standards, and professional and educational activities.

About IEC/IEEE publications
The technical content of IEC/IEEE publications is kept under constant review by the IEC and IEEE. 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
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 It also gives information on projects, replaced and withdrawn publications.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 once a month by email.

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: sales@iec.ch.

IEC Products & Services Portal - 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
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.

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

CONTENTS

FOREWORD 4
INTRODUCTION 8
1 Scope 9
2 Normative references 9
3 Terms and definitions 9
4 General requirements 15
4.1 Applicability of IEC 60079-0 15
4.2 General 21
4.3 Mechanical strength 21
4.4 Terminations and connections 22
4.5 Circuit protection requirements for branch circuits 22
4.6 Temperature requirements 23
4.6.1 General 23
4.6.2 Stabilized design 23
4.6.3 Controlled design 23
5 Testing 26
5.1 Type tests 26
5.1.1 General 26
5.1.2 Dielectric test 26
5.1.3 Electrical insulation resistance test 26
5.1.4 Flammability test 27
5.1.5 Impact test 28
5.1.6 Deformation test 31
5.1.7 Cold bend test 32
5.1.8 Water resistance test 33
5.1.9 Integral components' resistance to water test 34
5.1.10 Verification of rated output 34
5.1.11 Thermal stability of electrical insulating material 37
5.1.12 Thermal performance test 37
5.1.13 Determination of maximum sheath temperature 39
5.1.14 Verification of start-up current 47
5.1.15 Verification of the electrical resistance of electrically conductive covering 48
5.1.16 UV and condensation test 48
5.1.17 Connection Integrity (integral components) 48
5.2 Routine tests 50
5.2.1 Dielectric test 50
5.2.2 Verification of rated output 51
6 Marking 51
6.1 Product markings for trace heaters 51
6.2 Field assembled components 51
6.3 Product markings for high temperature limiters and temperature controllers 52
7 Documentation 52
7.1 General 52
7.2 Circuit design documentation 52
7.3 Trace heating system documentation 52

7.3.1 General 52
7.3.2 For trace heating systems according to the product classification method 52
7.3.3 For trace heating systems according to stabilized design method 53
7.3.4 For trace heating systems according to controlled design method 53
7.4 Instructions for installation of trace heating system 53
7.5 Instructions for commissioning 54
7.6 Instructions for maintenance / repair or modification 54
Annex A (informative) Type test matrix for EPLs Gb/Gc/Db/Dc (refer to IEC 60079-14 for the relationship of EPLs to Zones) 55
Annex B (informative) Checklist for installation 57
Annex C (normative) Trace heater product design verification methodology 58
C.1 General 58
C.2 Design methodology and selection of trace heaters 58
C.3 Stabilized design calculations 58
C.4 Trace heater performance and equilibrium conditions 59
C.5 Heat loss calculations 61
C.6 Heat loss design safety factor 62
C.7 Maximum temperature determination 62
C.7.1 Theoretical pipe and sheath temperature calculations - Metallic applications 62
C.7.2 Theoretical vessel and sheath temperature calculations - Metallic applications 63
C.7.3 Sheath temperature - metallic applications utilizing a temperature limiter sensing the trace heater sheath or an artificial hot spot 65
C.7.4 Theoretical sheath temperature calculations - Non-metallic applications 65
C.7.5 Sheath temperature - Non-metallic applications utilizing a temperature limiter control sensing the trace heater sheath or an artificial hot spot 67
Annex D (normative) Calculation methodology for coverage of electrically conductive covering 68
Annex E (normative) Applications of trace heating in empty conduit 69
E.1 General 69
E.2 Maximum sheath temperature - trace heating internal to conduit 69
E.3 Pull-strength test 69
E.4 Rated output 69
E.5 Verification of start-up current 70
Annex F (normative) Requirements for Division 1 and Division 2 trace heating systems 71
F.1 Application 71
F.2 General 71
F.3 Terminations and connections 71
F.4 Control and temperature requirements 71
F.4.1 General 71
F.4.2 Stabilized design 71
F.4.3 Controlled design 72
F.4.4 Requirements for protective device in Divisions 1 and 2 72
F.5 Type tests 72
F.5.1 Division 1 trace heating equipment 72
F.5.2 Division 2 trace heating equipment 73
F.6 Marking 73

F.7 Instructions - Installation requirements 73
Annex G (normative) Type test matrix for Division 1 and 2 explosive atmospheres 75
Bibliography 77

Figure 1 – Flammability test 28
Figure 2 – Example of room temperature impact test 30
Figure 3 – Example of minimum temperature impact test 31
Figure 4 – Cold bend test 33
Figure 5 – Integral components resistance to water test 34
Figure 6 – Verification of rated output 36
Figure 7 – Product classification approach 40
Figure 8 – Verification of sheath temperatures using pipe sculpture 42
Figure 9 – Verification of sheath temperature, plate test 45
Figure 10 – Verification of sheath temperature - plate test with serpentined sample 45
Figure 11 – Plate test with two samples crossed over 46
Figure 12 – Plate test with a single sample crossed over 47
Figure 13 – Typical splice firm attachment apparatus 49
Figure C.1 – Equilibrium conditions for workpiece maintenance 59
Figure C.2 – Equilibrium conditions for upper limit evaluation 60

Table 1 – Application or exclusion of specific clauses of IEC 60079-0 15
Table 2 – Sheath temperature design conditions based on Equipment Protection Levels (EPLs) - Stabilized design approach 23
Table 3 – Sheath temperature design conditions based on Equipment Protection Levels - Controlled design approach 24
Table 4 – Test voltages for the dielectric test 26
Table A.1 – Determination of test samples 55
Table B.1 – Trace heater installation record - Example 57
Table F.1 – Division trace heating systems 71
Table F.2 - Sheath temperature design conditions - Stabilized design approach 72
Table F.3 – Sheath temperature design conditions - With temperature controller and/or high temperature limiter 72
Table G.1 – Applicable trace heater and trace heater pads and panels tests by installation location 75
Table G.2 – Applicable tests for integral components with trace heaters and trace heater pads and panels 76

Explosive atmospheres - Part 30-1: Electrical resistance trace heating - General and testing 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 document(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.

   IEEE Standards documents are developed within IEEE Societies and Standards Coordinating Committees of the IEEE Standards Association (IEEE SA) Standards Board. IEEE develops its standards through a consensus development process, approved by the American National Standards Institute, which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of IEEE and serve without compensation. While IEEE administers the process and establishes rules to promote fairness in the consensus development process, IEEE does not independently evaluate, test, or verify the accuracy of any of the information contained in its standards. Use of IEEE Standards documents is wholly voluntary. *IEEE documents are made available for use subject to important notices and legal disclaimers (see* https://standards.ieee.org/ipr/disclaimers.html *for more information).*

   IEC collaborates closely with IEEE in accordance with conditions determined by agreement between the two organizations. This Dual Logo International Standard was jointly developed by the IEC and IEEE under the terms of that agreement.

2) The formal decisions 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. The formal decisions of IEEE on technical matters, once consensus within IEEE Societies and Standards Coordinating Committees has been reached, is determined by a balanced ballot of materially interested parties who indicate interest in reviewing the proposed standard. Final approval of the IEEE standards document is given by the IEEE Standards Association (IEEE SA) Standards Board.

3) IEC/IEEE Publications have the form of recommendations for international use and are accepted by IEC National Committees/IEEE Societies in that sense. While all reasonable efforts are made to ensure that the technical content of IEC/IEEE Publications is accurate, IEC or IEEE 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 (including IEC/IEEE Publications) transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC/IEEE Publication and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC and IEEE do not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC and IEEE are 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 IEEE or their directors, employees, servants or agents including individual experts and members of technical committees and IEC National Committees, or volunteers of IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (IEEE SA) Standards Board, 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/IEEE Publication or any other IEC or IEEE 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 implementation of this IEC/IEEE Publication may require use of material covered by patent rights. By publication of this standard, no position is taken with respect to the existence or validity of any patent rights in connection therewith. IEC or IEEE shall not be held responsible for identifying Essential Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patent Claims or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of this standard are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

IEC/IEEE 60079-30-1 has been prepared by IEC technical committee 31: Equipment for explosive atmospheres, in cooperation with the Petroleum & Chemical Industry Committee of the IEEE Industrial Applications Society under the IEC/IEEE Dual Logo Agreement.

This publication is published as an IEC/IEEE Dual Logo standard.

This second edition of IEC/IEEE 60079-30-1 cancels and replaces the first edition of IEC/IEEE 60079-30-1 published in 2015. This edition constitutes a technical revision.

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:

The significance of changes between IEC/IEEE 60079-30-1, Edition 1.0 (2015) and IEC/IEEE 60079-30-1, Edition 2.0 (this document) is as listed below:

		Type		
Changes	**Clause**	**Minor and editorial changes**	**Extension**	**Major technical changes**
Redefined Maximum withstand temperature as it applies to the performance benchmark test.	3.20	X		
Separated maximum maintain temperature and maximum continuous operating temperature to clarify the meaning of both terms.	3.15 and 3.16	X		
Addition of requirements for controllers and high temperature limiters, added specific reference standards.	4.6.3			C1
Rewrite of the requirements for controlled design as it applies to the application of controllers and high temperature limiters as for use in EPL's.	4.6.3			C2
Addition of requirement for specifying various temperatures defined by the standard and including them in user documentation.	4.2 and 7			C3
Connection Integrity (integral components)	5.1.17		X	
Applications of Trace Heating in empty conduit	Annex E		X	

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 1 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 There are no additional requirements for temperature controllers and high temperature limiters beyond those of the general industrial standards.

C2 The application of temperature controllers and high temperature limiters shall be as specified.

C3 The documentation shall include the various temperatures specified in the standard.

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

Draft	Report on voting
31/1867/FDIS	31/1893/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 the rules given in the ISO/IEC Directives, Part 2, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications/.

This document is to be used in conjunction with IEC 60079-0, *Explosive atmospheres - Part 0: Equipment - General requirements* and IEC/IEEE 60079-30-2, *Explosive atmospheres - Part 30-2: Electrical resistance trace heating - Guidance on application for design, installation and maintenance.*

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

The IEC Technical Committee and IEEE Technical Committee have decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,

– withdrawn, or

– revised.

INTRODUCTION

IEC/IEEE 60079-30-1 is intended to provide a comprehensive overview of the essential requirements and testing appropriate to electric surface heating equipment used in explosive atmospheres. The requirements of this part of IEC 60079 are considered to be the minimum requirements for Equipment Protection Levels (EPLs) Gb, Gc, Db, and Dc in explosive atmospheres for gases, dusts, and fibres/flyings. While some of this work already exists in national standards or international standards, this document has collated much of this existing work and added to it. This document also contains the minimum requirements for users applying the Division method of area classification.

1 Scope

This part of IEC 60079 specifies general and testing requirements for electrical resistance trace heaters for application in explosive atmospheres with the exclusion of those for Equipment Protection Levels (EPL) Ga, Da, Ma and Mb equipment. This document covers trace heaters that comprise either factory or field (worksite) assembled units, and which can be series trace heaters, parallel trace heaters, trace heater pads, or trace heater panels that have been assembled and/or terminated in accordance with the manufacturer's instructions.

This document also includes requirements for termination assemblies and control methods used with trace heating systems. The explosive atmospheres referred to in this document are those defined in IEC 60079-10-1 and IEC 60079-10-2.

Annex F and Annex G outline the application of this document for those users applying the Division method of area classification.

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 60050-151, *International Electrotechnical Vocabulary (IEV) - Part 151: Electrical and magnetic devices*

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

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

IEC/IEEE 60079-30-2, *Explosive atmospheres - Part 30-2: Electrical resistance trace heating - Guidance on application for design, installation and maintenance*

IEC 60695-11-3, *Fire hazard testing - Part 11-3: Test flames - 500 W flames - Apparatus and confirmational test methods*

ISO 4892-2, *Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps*

ASTM G155, *Standard practice for operating xenon arc light apparatus for exposure of non-metallic materials*