

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Safety in installations for electroheating and electromagnetic processing –
Part 12: Particular requirements for infrared electroheating**

**Sécurité dans les installations destinées au traitement électrothermique et
électromagnétique –
Partie 12: Exigences particulières pour chauffage électrique par rayonnement
infrarouge**





THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2016 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 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 20 000 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

65 000 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.

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.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

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

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

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 15 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.



IEC 60519-12

Edition 2.0 2016-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Safety in installations for electroheating and electromagnetic processing –
Part 12: Particular requirements for infrared electroheating**

**Sécurité dans les installations destinées au traitement électrothermique et
électromagnétique –
Partie 12: Exigences particulières pour chauffage électrique par rayonnement
infrarouge**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 25.180.10

ISBN 978-2-8322-3709-0

**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.....	4
INTRODUCTION.....	6
1 Scope and object.....	7
2 Normative references	8
3 Terms, definitions and abbreviations	8
4 Classification and sub-division.....	10
5 Risk assessment	11
6 General provisions.....	11
7 Protection against electric shock	11
8 Protection against hazards caused by electric or magnetic nearfields	11
9 Protection against hazards from radiation.....	11
10 Protection against hazards from thermal influences	13
11 Protection against hazards from fire	13
12 Protection against hazards from fluids	13
13 Specific requirements for components and subassemblies	13
14 Control of the installation or equipment.....	13
15 Protection against mechanical hazards.....	13
16 Protection against hazards resulting from use	13
17 Protection against other hazards	13
18 Verification and testing	13
19 Information for use	14
Annex A (informative) List of significant hazards.....	15
Annex B (informative) Electric and magnetic fields, touch currents – limits of exposure hazards	16
Annex C (informative) Optical radiation – limits of exposure hazards	17
Annex D (informative) Limits for exposure hazards – noise and vibration	19
Annex E (normative) Provisions concerning EMC.....	20
Annex F (normative) Marking and warning	21
Annex G (informative) Guidelines on using this standard	22
Annex H (informative) Connection with ISO 13577 series.....	23
Annex AA (informative) Procedure for reducing risk from infrared radiation.....	24
Annex BB (informative) Simplified measurement method for the assessment of thermal infrared radiation exposure.....	26
Annex CC (informative) Measurement device for total irradiance	32
Bibliography.....	33
Figure C.101 – Risk groups and exposure limits (refer to Table C.1 of IEC 60519-1:2015) depending on time of exposure and irradiation.....	17
Figure C.102 – Risk groups and exposure limits (refer to Table C.2 of IEC 60519-1:2015) depending on time of exposure and radiance.....	18
Figure BB.1 – Factors for converting measured total irradiance into band irradiance, depending on surface temperature of a grey emitter generating the signal.....	28

Figure BB.2 – Factor for converting measured total radiance into relevant retinal thermal radiance, depending on surface temperature of a grey emitter generating the signal..... 31

Figure CC.1 – Example of a detector for total irradiance measurement 32

Table AA.1 – Procedure for assessment and reduction of radiation exposure through design..... 25

Table BB.1 – Measurement procedure 26

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SAFETY IN INSTALLATIONS FOR ELECTROHEATING AND ELECTROMAGNETIC PROCESSING –

Part 12: Particular requirements for infrared electroheating

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 60519-12 has been prepared by IEC technical committee 27: Industrial electroheating and electromagnetic processing.

This second edition cancels and replaces the first edition published in 2013. This edition constitutes a technical revision.

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

- a) the structure has been redrafted according to IEC 60519-1:2015;
- b) terms/definitions, normative references and bibliography have been updated and completed;
- c) all requirements and content from IEC 60519-12:2013 that have been included in IEC 60519-1:2015 have been removed to avoid any duplication.

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

CDV	Report on voting
27/967/CDV	27/982/RVC

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

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

A list of all parts in the IEC 60519 series, published under the general title *Safety in installations for electroheating and electromagnetic processing*, 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 the next edition.

The clauses of parts of the IEC 60519 series (hereinafter called Particular Requirements) supplement or modify the corresponding clauses of IEC 60519-1:2015 (*General Requirements* hereinafter called Part 1).

This part of IEC 60519 is to be read in conjunction with Part 1. It supplements or modifies the corresponding clauses of Part 1. Where the text indicates an "addition" to or a "replacement" of the relevant provision of Part 1, these changes are made to the relevant text of Part 1. Where no change is necessary, the words "This clause of Part 1 is applicable" are used. When a particular subclause of Part 1 is not mentioned in this part, that subclause applies as far as is reasonable.

Additional specific provisions to those in Part 1, given as individual clauses or subclauses, are numbered starting from 101.

NOTE The following numbering system is used:

- subclauses, tables and figures that are numbered starting from 101 are additional to those in Part 1;
- unless notes are in a new subclause or involve notes in Part 1, they are numbered starting from 101, including those in a replaced clause or subclause;
- additional annexes are lettered AA, BB, etc.

In this standard, the following print types are used:

- requirements and definitions: in roman type;
- NOTES: in smaller roman type;
- terms used throughout this standard which have been defined in Clause 3: **in bold type**.

INTRODUCTION

The scope of this standard covers a broad range of types and designs of infrared equipment which are used for many different purposes. This standard is intended to cover all industrial infrared equipment types, with some few exceptions provided in Clause 1.

Many other types of electroheating equipment emit infrared radiation of hazardous levels, therefore IEC 60519-1:2015 provides all general requirements addressing optical radiation and this document provides specific considerations for infrared equipment and helpful methods.

With reference to IEC 60519-2:2006 it has been agreed in TC 27 that this standard covers all kinds of infrared emission hazards of industrial electroheating installations and provisions not given in IEC 60519-1:2015.

The discussion of infrared radiation assessment has become quite detailed in this standard, as for the industry there is not any single useful source available for simple, versatile, easy to use and cost effective measurement methods.

The other principles for covering the risks caused by infrared radiation were:

- the manufacturer usually does not employ an expert in optical radiation measurement or has access to an optical laboratory with all the necessary equipment needed for elaborate measurements;
- operating staff with limited experience in radiation measurement is usually responsible for the task of performing the necessary measurements and will appreciate a simple and easy to follow guide;
- the scope of IEC 62471:2006 is limited to lamps but is applicable for other light sources. Therefore, core aspects were adapted from that standard and if possible simplified for this document.
- figures illustrating the classes defined in IEC 62471:2006 and listed in IEC 60519-1:2015 are included;
- relevant documents of American National Standard Institute/Illuminating Engineering Society of North America, the ANSI/IESNA RP 27 series, are based on the ICNIRP recommendations as well. They provide no extra or contradictory material with regard to this standard and its references.

SAFETY IN INSTALLATIONS FOR ELECTROHEATING AND ELECTROMAGNETIC PROCESSING –

Part 12: Particular requirements for infrared electroheating

1 Scope and object

1.1 Scope

This clause of Part 1 is replaced by the following.

Replacement:

This part of IEC 60519 specifies safety requirements for industrial electroheating equipment and installations in which infrared radiation – usually generated by infrared emitters – is significantly dominating over heat convection or heat conduction as means of energy transfer to the workload. A further limitation of the scope is that the infrared emitters have a maximum spectral emission at longer wavelengths than 780 nm in air or vacuum, and are emitting wideband continuous spectra such as by thermal radiation or high pressure arcs.

IEC 60519-1:2015 defines infrared as radiation within the frequency range between 400 THz and 300 GHz. This corresponds to a wavelength range between 780 nm and 10 µm in vacuum. Industrial infrared heating commonly uses thermal infrared sources with rated temperatures between 500 °C and 3 000 °C; the emitted radiation from these sources dominates in the wavelength range between 780 nm and 10 µm.

Since substantial emission of thermal emitters can extend either to wavelengths below 780 nm or above 3 000 nm, the safety aspects of emitted visible light and emission at wavelengths longer than 3 000 nm are also considered in this document.

This standard is not applicable to:

- infrared installations with lasers or light-emitting diodes (LEDs) as main sources – they are covered by IEC 62471:2006 and IEC 60825-1:2014;
- appliances for use by the general public;
- appliances for laboratory use – they are covered by IEC 61010-1:2010;
- electroheating installations where resistance heated bare wires, tubes or bars are used as heating elements, and infrared radiation is not a dominant side effect of the intended use, covered by IEC 60519-2:2006;
- infrared heating equipment with a nominal combined electrical power of the infrared emitters of less than 250 W;
- handheld infrared equipment.

Industrial infrared electroheating equipment under the scope of this standard typically uses the Joule effect for the conversion of electric energy into infrared radiation by one or several sources. Radiation is then emitted from one or several elements onto the material to be treated. Such infrared heating elements are in particular:

- thermal infrared emitters in the form of tubular, plate-like or otherwise shaped ceramics with a resistive element inside;
- infrared quartz glass tube or halogen lamp emitters with a hot filament as a source;