

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Electric room heating – Underfloor heating – Performance characteristics –
Definitions, method of testing, sizing and formula symbols**

**Chauffage électrique de locaux – Chauffage par le sol – Caractéristiques de
performance – Définitions, méthode d'essai, calibrage et symboles de formule**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2021 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
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 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 It also gives information on projects, replaced and withdrawn publications.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 online collection - oc.iec.ch

Discover our powerful search engine and read freely all the publications previews. 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 22 000 terminological entries in English and French, with equivalent terms in 18 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

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 une fois par mois par email.

Service Clients - 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.

IEC online collection - oc.iec.ch

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

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Electric room heating – Underfloor heating – Performance characteristics –
Definitions, method of testing, sizing and formula symbols**

**Chauffage électrique de locaux – Chauffage par le sol – Caractéristiques de
performance – Définitions, méthode d'essai, calibrage et symboles de formule**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 97.100.10

ISBN 978-2-8322-1035-3

**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.**

REDLINE VERSION

VERSION REDLINE



**Electric room heating – Underfloor heating – Performance characteristics –
Definitions, method of testing, sizing and formula symbols**

**Chauffage électrique de locaux – Chauffage par le sol – Caractéristiques de
performance – Définitions, méthode d'essai, calibrage et symboles de formule**

CONTENTS

FOREWORD.....	6
1 Scope.....	8
2 Normative references.....	8
3 Terms and definitions	8
4 Method of testing for the determination of characteristics of performance.....	15
4.1 General.....	15
4.2 Standard heating load per unit area	16
4.3 Maximum power rating per unit area	16
4.4 Maximum surface temperature.....	16
4.5 Maximum floor surface temperature for underfloor storage heating.....	17
4.6 Room air temperature.....	19
4.7 Internal surface temperatures on the surrounding surfaces of the room	20
4.8 Thermal pre-conditioning of the room to be tested.....	20
4.9 Floor temperature in the case of continuous local hot spots.....	21
4.10 Floor temperature of underfloor storage heating through failure of a switching, controlling or regulation apparatus.....	23
4.11 Floor temperature of controlled underfloor heating and underfloor direct heating through failure of a switching, controlling or regulation apparatus.....	23
4.12 Regulation of room temperature using peripheral areas for underfloor storage heating	23
4.13 Regulation of room temperature using controlled underfloor heating and underfloor direct heating.....	23
4.14 Regulation of room temperature using underfloor warming	24
4.15 Relationship of coefficients of heat transfer.....	24
4.16 Insulating layers.....	24
4.17 Edging insulation strips	25
4.18 Damp-proofing	25
4.19 Electrical auxiliary heating.....	26
4.20 Load distribution layer in electrical underfloor heating	26
4.21 Bedding in or under heating screed or directly below floor covering.....	26
4.22 Dry laying of electrical heating elements	26
4.23 Heating element.....	26
4.24 Heating cable and laminar heating element.....	26
4.24.1 Heating cable for bedding in or under screeding or directly below floor covering.....	26
4.24.2 Heating cable for dry laying.....	26
4.24.3 Laminar heating elements for installation below or in screeding.....	26
4.25 Characteristics of heating cables	27
4.26 Characteristics of laminar heating elements	27
4.27 Cold tails	27
4.28 Point of connection	27
4.29 Bending radius of the heating cable	27
4.30 Heating element labelling	27
4.31 Pulsation factor	27
4.32 Installation of heating elements for underfloor direct heating	27
4.33 Adhesive and fixing material.....	28
4.34 Permanent installation areas	28

4.35	Pre-heating of screeding	28
4.36	Floor coverings	28
4.37	Control and regulation equipment	28
4.38	Control and regulation equipment for underfloor storage heating	28
4.39	Control and regulation equipment for controlled underfloor heating and underfloor direct heating	28
4.40	Floor temperature measurement	28
4.41	Auxiliary supply period	29
4.42	Period of room use	29
4.43	Insulation and dielectric resistance of the heating element	29
4.44	Instructions for construction workers	29
4.44.1	Protective measures when pouring flooring screed	29
4.44.2	Pouring the screed	29
4.45	Data for owner and user of the building	29
4.46	Report of testing	30
Annex A	(informative) Sizing procedure – Range of application and purpose	31
A.1	General	31
A.2	Basic principles – Basic parameters of the room to be heated	31
A.2.1	General	31
A.2.2	Standard heat load of an underfloor heated room	31
A.2.3	Standard heating load per unit area	31
A.2.4	Effective heat storage capacity of the room to be heated	32
A.2.5	Peripheral conditions and limiting values	32
A.3	Sizing an underfloor heating system	33
A.3.1	Storage layer depth of an underfloor heating system	33
A.3.2	Heat load coverage for the underfloor heated room	33
Annex B	(informative) Sizing procedure – Examples of sizing procedure of an underfloor storage heating system – Example for a living area	48
B.1	General	48
B.2	Standard heat load of an underfloor heated room $\dot{Q}_N^*$	48
B.3	Standard heat load per unit area $\dot{q}_N^*$	48
B.4	Storage mass per unit external area of the room $m/\Sigma A_a$	48
B.5	Thickness of storage layer δ	49
B.6	Relation of coefficients of conductivity	49
B.7	Maximum rating per unit area P'_F	50
B.8	Limited rating per unit area P'_{FE}	50
B.9	Heating floor area A_F	50
B.10	Permissible rating P_{ZUL}	50
B.11	Rating of the room P	51
B.12	Rating per unit area P'_N	51
B.13	Mean heating capacity $\dot{Q}_F$	51
B.14	Auxiliary heating capacity $\dot{Q}_Z$	51
B.15	Auxiliary heat rating	52
Annex C	(informative) Sizing procedure – Example of sizing procedure of an underfloor direct heating system – Example for a living area	53
C.1	General	53

C.2	Design heating capacity $\dot{Q}_H^*$ of a room with underfloor direct heating.....	53
C.3	Design heating capacity per unit area $\dot{q}_H^*$	53
C.4	Depth of the heating screed.....	54
C.5	Relation of coefficients of conductivity	54
C.6	Maximum rating per unit area P'_F	55
C.7	Limited rating per unit area P'_{FE}	55
C.8	Heating floor area A_F	55
C.9	Permissible rating P_{ZUL}	56
C.10	Rating of the room P	56
C.11	Rating per unit area P'_N	56
C.12	Mean heating capacity $\dot{Q}_F$	56
C.13	Auxiliary heating capacity $\dot{Q}_Z$	56
C.14	Formula symbols and units.....	56
Annex D (informative) Complete performance test according to Commission Regulation (EU) 2015/1188		59
D.1	Test conditions.....	59
D.2	Definitions.....	59
D.3	Requirements to comply with functions according to Commission Regulation (EU) 2015/1188.....	63
D.3.1	General	63
D.3.2	Product equipped with single stage heat output, no room temperature control	63
D.3.3	Product equipped with two or more manual stages, no room temperature control	63
D.3.4	Product equipped with mechanical room temperature control	63
D.3.5	Product equipped with electronic room temperature control.....	63
D.3.6	Product equipped with electronic room temperature control plus day timer	63
D.3.7	Product equipped with electronic room temperature control plus week timer	64
D.3.8	Product equipped with room temperature control, with presence detection.....	64
D.3.9	Product equipped with room temperature control, with open window detection.....	64
D.3.10	Product equipped with distance control option	65
D.3.11	Product equipped with adaptive start control.....	65
D.3.12	Product equipped with working time limitation	65
D.3.13	Product equipped with black bulb sensor	66
D.4	Information provided at point of sale	66
Annex E (informative) Climatic test room		67
E.1	Climatic test room A	67
E.2	Climatic test room B	68
Bibliography		69
Figure 1 – Layout diagram of an underfloor heating system		13
Figure 2 – Construction A, cross-section A – B		14
Figure 3 – Construction B, cross-section A – B		14

Figure 4 – Construction C, cross-section A – B.....	14
Figure 5 – Examples for the effect of floor excess temperature T_E	17
Figure 6 – Basic circuit diagram of underfloor storage heating	19
Figure 7 – Underfloor direct heating, controlled underfloor heating and warming – Example of a circuit for individual room regulation (rooms have one heating circuit each).....	21
Figure 8 – Construction of model.....	22
Figure A.1 – Monogram for determining the storage layer depth.....	32
Figure A.2 – Electric underfloor storage heating, sizing chart.....	34
Figure A.3 – Electric underfloor direct and controlled heating, sizing chart	35
Figure A.4 – Plan of basement	43
Figure A.5 – Plan of ground floor.....	44
Figure A.6 – Plan of upper floor	45
Figure A.7 – Cross-section A – B	46
Figure A.8 – Cross-section C – D	47
Figure B.1 – Ceiling construction.....	48
Figure C.1 – Ceiling construction	53
Figure E.1 – Example of a climatic test room	68
Table 1 – Minimum coefficient of heat transfer and minimum resistance to thermal conductivity of construction elements	25
Table A.1 – $\vartheta_1 - \vartheta'_1 = 0K$	36
Table A.2 – $\vartheta_1 - \vartheta'_1 = 5K$	36
Table A.3 – $\vartheta_1 - \vartheta'_1 = 10K$	37
Table A.4 – $\vartheta_1 - \vartheta'_1 = 15K$	37
Table A.5 – $\vartheta_1 - \vartheta'_1 = 20K$	38
Table A.6 – $\vartheta_1 - \vartheta'_1 = 30K$	38
Table A.7 – $\vartheta_1 - \vartheta'_1 = 35K$	39
Table A.8 – $\vartheta_1 - \vartheta'_1 = 38K$	39
Table B.1 – Determination of heat conductivity coefficient U_O	49
Table B.2 – Determination of heat conductivity coefficient U_U	50
Table C.1 – Determination of heat conductivity coefficient U_O	54
Table C.2 – Determination of heat conductivity coefficient U_U	55

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTRIC ROOM HEATING – UNDERFLOOR HEATING –
PERFORMANCE CHARACTERISTICS – DEFINITIONS, METHOD
OF TESTING, SIZING AND FORMULA SYMBOLS**

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.

This consolidated version of the official IEC Standard and its amendment has been prepared for user convenience.

IEC 62999 edition 1.1 contains the first edition (2016-02) [documents 59C/193/CDV and 59C/197/RVC] and its amendment 1 (2021-10) [documents 59C/250/CDV and 59C/197/RVC].

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 62999 has been prepared by subcommittee 59C: Heating appliances, of IEC technical committee 59: Performance of household and similar electrical appliances.

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

The committee has decided that the contents of the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

ELECTRIC ROOM HEATING – UNDERFLOOR HEATING – PERFORMANCE CHARACTERISTICS – DEFINITIONS, METHOD OF TESTING, SIZING AND FORMULA SYMBOLS

1 Scope

This International Standard applies to electrical underfloor heating of dwellings and all other buildings whose use corresponds to dwellings or is at least similar, having a maximum load bearing in use of 4 kN/m².

This Standard defines the main characteristics of electrical underfloor heating and establishes the method of testing of these characteristics as information for the user.

This Standard does not deal with:

- installation and safety requirements.

Annexes D and E are added for information purposes about performance testing according to the European Commission Regulation (EU) 2015/1188.

2 Normative references

IEC 60335-2-96, *Household and similar electrical appliances – Safety – Part 2-96: Particular requirements for flexible sheet heating elements for room heating*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

electrical underfloor heating system

electrical underfloor heating, switching, control and regulation appliances and electrical installation

3.1.1

underfloor heating

in situ flooring constructed as an electrical underfloor heating system

Note 1 to entry: It is generally laid on a dry, level, load-bearing substructure.

3.1.2

underfloor direct heating

underfloor direct heating, by which the heat generated from electrical energy is transferred with the least possible time lag to the room to be heated mainly via the surface of the floor

Note 1 to entry: There is no restriction on the amount of time electrical energy can be converted into heat.

3.1.3

underfloor warming

underfloor warming increases comfort by means of pleasant warmth on the feet

Note 1 to entry: It is not necessary to calculate the heat load of the room, and the insulating layers as the underfloor warming are not considered when calculating the heat load of the room.