



BSI Standards Publication

**Electric room heating, underfloor heating,  
characteristic of performance - Definitions,  
method of testing, sizing and formula symbols**

---

## National foreword

This British Standard is the UK implementation of EN 50559:2013+A1:2020. It supersedes BS EN 50559:2013, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CENELEC text carry the number of the CENELEC amendment. For example, text altered by CENELEC amendment A1 is indicated by A1 A1.

The UK participation in its preparation was entrusted to Technical Committee CPL/59, Performance of household electrical appliances.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2020  
Published by BSI Standards Limited 2020

ISBN 978 0 539 06295 3

ICS 97.100.10

**Compliance with a British Standard cannot confer immunity from legal obligations.**

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 October 2015.

### Amendments/corrigenda issued since publication

| Date            | Text affected                               |
|-----------------|---|
| 31 October 2015 | Correction to BS identifier                 |
| 31 May 2020     | Implementation of CENELEC amendment A1:2020 |

English version

**Electric room heating, underfloor heating, characteristics of performance -  
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

Elektrische Raumheizung,  
Fußbodenheizung, Charakteristika der  
Gebrauchstauglichkeit -  
Definitionen, Testmethoden,  
Dimensionierung und Formelsymbole

This European Standard was approved by CENELEC on 2012-12-24. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

**CENELEC**

European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**

| <b>Contents</b>  | <b>Page</b> |
|--|-------------|
| Forewords.....   | 7           |
| Introduction .....   | 8           |
| 1 Scope.....   | 9           |
| 2 Normative references .....   | 9           |
| 3 Terms and definitions .....  | 9           |
| 4 Method of testing for the determination of characteristics of performance .....  | 17          |
| 4.1 General.....   | 17          |
| 4.2 Standard heating load per unit area .....  | 17          |
| 4.3 Maximum power rating per unit area .....   | 17          |
| 4.4 Maximum surface temperature.....   | 17          |
| 4.5..... Maximum floor surface temperature for underfloor storage heating  |             |
| 4.6 Room air temperature.....  | 20          |
| 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 .....  | 25          |
| 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.....  | 26          |
| 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 .....  | 27 |
| 4.34   | Permanent installation areas .....  | 27 |
| 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 .....   | 28 |
| 4.42   | Period of room use .....  | 28 |
| 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 ..... | 46 |
| B.1    | General .....   | 46 |
| B.2    | Standard heat load of an underfloor heated room $\dot{Q}_N^*$ .....   | 46 |
| B.3    | Standard heat load per unit area $\dot{q}_N^*$ .....  | 46 |
| B.4    | Storage mass per unit external area of the room $m/\Sigma A_a$ .....  | 46 |
| B.5    | Thickness of storage layer $\delta$ .....   | 47 |

|                           |   |    |
|---------------------------|---|----|
| B.6                       | Relation of coefficients of conductivity.....   | 47 |
| B.7                       | Maximum rating per unit area $P'_F$ .....   | 48 |
| B.8                       | Limited rating per unit area $P'_{FE}$ .....  | 48 |
| B.9                       | Heating floor area $A_F$ .....  | 48 |
| B.10                      | Permissible rating $P_{ZUL}$ .....  | 48 |
| B.11                      | Rating of the room $P$ .....  | 48 |
| B.12                      | Rating per unit area $P'_{IN}$ .....  | 48 |
| B.13                      | Mean heating capacity $\dot{Q}_F$ .....   | 48 |
| B.14                      | Auxiliary heating capacity $\dot{Q}_Z$ .....  | 49 |
| B.15                      | Auxiliary heat rating .....   | 49 |
| Annex C (informative)     | Sizing procedure — Example of sizing procedure of an underfloor direct heating system — Example for a living area ..... | 50 |
| C.1                       | General.....  | 50 |
| C.2                       | Design heating capacity $\dot{Q}_H^*$ of a room with underfloor direct heating.....                                     | 50 |
| C.3                       | Design heating capacity per unit area $\dot{q}_H^*$ .....   | 50 |
| C.4                       | Depth of the heating screed.....  | 51 |
| C.5                       | Relation of coefficients of conductivity.....   | 51 |
| C.6                       | Maximum rating per unit area $P'_F$ .....   | 52 |
| C.7                       | Limited rating per unit area $P'_{FE}$ .....  | 52 |
| C.8                       | Heating floor area $A_F$ .....  | 52 |
| C.9                       | Permissible rating $P_{ZUL}$ .....  | 52 |
| C.10                      | Rating of the room $P$ .....  | 52 |
| C.11                      | Rating per unit area $P'_{IN}$ .....  | 52 |
| C.12                      | Mean heating capacity $\dot{Q}_F$ .....   | 52 |
| C.13                      | Auxiliary heating capacity $\dot{Q}_Z$ .....  | 53 |
| Formula symbols and units | .....   | 54 |
| Annex D (normative)       | Performance test according to Commission Regulation (EU) 2015/1188 .....  | 56 |
| D.1                       | Test conditions.....  | 56 |
| D.2                       | Definitions .....   | 56 |
| D.3                       | Requirements to comply with functions according to Commission Regulation (EU) 2015/1188.....                            | 60 |
| D.3.1                     | Product equipped with single stage heat output, no room temperature control .....                                       | 60 |
| D.3.2                     | Product equipped with two or more manual stages, no room temperature control .....                                      | 60 |
| D.3.3                     | Product equipped with mechanical room temperature control .....   | 60 |
| D.3.4                     | Product equipped with electronic room temperature control .....   | 60 |
| D.3.5                     | Product equipped with electronic room temperature control plus day timer.....   | 61 |
| D.3.6                     | Product equipped with electronic room temperature control plus week timer .....   | 61 |

|                        |  |    |
|------------------------|--|----|
| D.3.7                  | Product equipped with room temperature control, with presence detection.....   | 61 |
| D.3.8                  | Product equipped with room temperature control, with open window detection .....   | 61 |
| D.3.9                  | Product equipped with distance control option .....  | 62 |
| D.3.10                 | Product equipped with adaptive start control.....  | 62 |
| D.3.11                 | Product equipped with working time limitation .....  | 63 |
| D.3.12                 | Product equipped with black bulb sensor .....  | 63 |
| D.4                    | Information provided at point of sale .....  | 63 |
| Annex E (normative)    | Climatic test room .....   | 65 |
| E.1                    | Climatic test room A .....   | 65 |
| E.2                    | Climatic test room B .....   | 66 |
| Annex ZZ (informative) | Relationship between this European Standard and the ecodesign requirements of Commission Regulation (EU) 2015/1188 aimed to be covered .....                           | 67 |
| Bibliography           | .....  | 68 |
| Figure 1               | — Layout diagram of an underfloor heating system.....  | 12 |
| Figure 2               | — Construction „A“, Cross-section A – B .....  | 13 |
| Figure 3               | — Construction “B“, Cross-section A – B .....  | 13 |
| Figure 4               | — Construction “C” Cross-section A – B.....  | 14 |
| Figure 5               | — Examples for the effect of floor excess temperature TE .....   | 16 |
| Figure 6               | — Basic circuit diagram of underfloor storage heating.....   | 17 |
| Figure 7               | — Underfloor direct heating, controlled underfloor heating and warming — Example of a circuit for individual room regulation. Rooms have one heating circuit each..... | 19 |
| Figure 8               | — Construction of model.....   | 20 |
| Figure A.1             | — Monogram for determining the storage layer depth .....   | 30 |
| Figure A.2             | — Electric underfloor storage heating, sizing chart.....   | 32 |
| Figure A.3             | — Electric underfloor direct and controlled heating, sizing chart .....  | 33 |
| Figure A.4             | — Plan of basement.....  | 39 |
| Figure A.5             | — Plan of ground floor .....   | 40 |
| Figure A.6             | — Plan of upper floor .....  | 41 |
| Figure A.8             | — Cross section C – D.....   | 43 |
| Figure B.1             | — Ceiling construction .....   | 44 |
| Figure C.1             | — Ceiling construction .....   | 48 |
| Table 1                | — Minimum coefficient of heat transfer and minimum resistance to thermal conductivity of construction elements .....   | 23 |
| Table A.1              | — $\vartheta_1 - \vartheta'_1 = 0\text{K}$ .....   | 34 |
| Table A.2              | — $\vartheta_1 - \vartheta'_1 = 5\text{K}$ .....   | 34 |
| Table A.3              | — $\vartheta_1 - \vartheta'_1 = 10\text{K}$ .....  | 34 |

|  |    |
|--|----|
| Table A.4 — $\vartheta_1 - \vartheta'_1 = 15\text{K}$ .....  | 34 |
| Table A.5 — $\vartheta_1 - \vartheta'_1 = 20\text{K}$ .....  | 35 |
| Table A.6 — $\vartheta_1 - \vartheta'_1 = 30\text{K}$ .....  | 35 |
| Table A.7 — $\vartheta_1 - \vartheta'_1 = 35\text{K}$ .....  | 35 |
| Table A.8 — $\vartheta_1 - \vartheta'_1 = 38\text{K}$ .....  | 35 |
| Table A.9 — Factor of limitation C in relation to standard heat load per unit area $\dot{q}_N^*$ ..... | 36 |
| Table B.1 — Determination of heat conductivity coefficient $U_0$ .....                                 | 45 |
| Table B.2 — Determination of heat conductivity coefficient $U_u$ .....                                 | 45 |
| Table C.1 — Determination of heat conductivity coefficient $U_0$ .....                                 | 49 |
| Table C.2 — Determination of heat conductivity coefficient $U_u$ .....                                 | 49 |



## European foreword

This document (EN 50559:2013) has been prepared by CLC/TC 59X "Performance of household and similar electrical appliances".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-12-24
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2015-12-24

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

## Foreword to amendment A1

This document (EN 50559:2013/A1:2020) has been prepared by CLC/TC 59X "Performance of household and similar electrical appliances".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2021-03-18
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2023-03-18

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2015/1188.

For the relationship with EU Directive 2015/1188 see informative Annex ZZ, which is an integral part of this document.

## Introduction

*No draft of this present preliminary standard has been published.*

A preliminary standard is the result of standardisation work which, due to certain reservations about the contents or due to a compilation process deviating from a standard, has not yet been published by DIN.

The national working body UK 513.4 „Raumheizgeräte“ (Room Heating) of the DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE (<http://www.dke.de>) is responsible for this preliminary standard.

In cases of a dated reference in the normative text, the reference is always applied to the issue being referred to.

The correlation between the quoted standard and the relevant German Standard is given in so far as a correlation exists, fundamentally by means of the number of the relevant IEC-Publication.

Example: IEC 60068 has been taken over by CENELEC as EN 60068, and incorporated into the German Standards as DIN EN 60068.

**A1** Annexes D, E and ZZ are added for the purpose of performance testing according to Commission Regulation (EU) 2015/1188. **A1**

## 1 Scope

This European 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/m<sup>2</sup>.

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

This European Standard does not deal with:

- installation and safety requirements;
- DIN VDE 0100-723.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1264-1, *Water based surface embedded heating and cooling systems — Part 1: Definitions and symbols*

EN 1264-2, *Water based surface embedded heating and cooling systems — Part 2: Floor heating: Prove methods for the determination of the thermal output using calculation and test methods*

EN 1264-3, *Water based surface embedded heating and cooling systems — Part 3: Dimensioning*

EN 1264-4, *Water based surface embedded heating and cooling systems — Part 4: Installation*

EN 1264-5, *Water based surface embedded heating and cooling systems — Part 5: Heating and cooling surfaces embedded in floors, ceilings and walls — Determination of the thermal output*

EN 12831, *Heating systems in buildings — Method for calculation of the design heat load*

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

## 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, the switching, control and regulation appliances and the electrical installation

#### 3.1.1

##### **underfloor heating**

in situ flooring constructed as a 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.