

Floor heating — Systems and components

Part 2. Determination of the thermal output

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ICS 91.140.10

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English version

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Chauffage par le sol — Systèmes et composants —
Partie 2: Détermination de l'émission thermique

Fußboden-Heizung — Systeme und
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Wärmeleistung

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CEN

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 130, Space heating appliances without integral heat sources, the Secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 1998, and conflicting national standards shall be withdrawn at the latest by February 1998.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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Introduction

This European Standard for floor heating systems consists of the following Parts:

- Part 1: Definitions and symbols;
- Part 2: Determination of the thermal output;
- Part 3: Dimensioning;
- Part 4: Installation.

1 Scope

This European Standard is applicable to hot water floor heating systems as defined in EN 1264-1.

The determination of thermal performance of hot water floor heating systems and their conformity to this standard is carried out by calculation in accordance with design documents and model: in the case of special constructions and if necessary, the determination of thermal performance by calculation is combined with measurement techniques.

This European Standard specifies procedures and conditions to enable the heat flow density of hot water floor heating systems to be determined relative to the heating medium differential temperature for standard systems. For special systems the additional influencing factors are experimentally determined and introduced in the calculation. This should enable a uniform assessment and calculation of floor heating systems.

The nominal heat flow density, the associated nominal heating medium differential temperature and the field of characteristic curves for the relationship between heat flow density and the determining variables are given as the result.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate place in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies :

EN 1264-1 *Floor heating — Systems and components — Part 1: Definitions and symbols*

3 Definitions and symbols

For the purposes of this standard, the definitions and symbols given in EN 1264-1 apply.

4 Thermal boundary conditions

A floor heating surface with a given average surface temperature delivers the same heat flow density in any room with the same indoor room temperature (nominal indoor room temperature θ_i) [1]. It is therefore possible to give a basic characteristic curve, independent of the heating system, which is applicable to all floor heating surfaces (including those with peripheral areas with greater heat emissions), for the relationship between heat flow density and average differential surface temperature (see figure A.1).

In contrast, for every floor heating system there is a maximum allowable heat flow density, the limit heat flow density q_G . This is determined for a nominal indoor room temperature of $\theta_i = 20^\circ\text{C}$ under the secondary condition that the maximum surface temperature $\theta_{F,\max} = 29^\circ\text{C}$ ¹⁾ at $\sigma = 0\text{ K}$. The maximum heat flow density for the peripheral area is reached at a maximum surface temperature of $\theta_{F,\max} = 35^\circ\text{C}$ ²⁾ and $\sigma = 0\text{ K}$.

For calculation the centre of the heating floor area, regardless of the type of system, is used as a reference point for $\theta_{F,\max}$ [2].

The average floor surface temperature $\theta_{F,m}$, which determines the heat flow density (refer to basic characteristic curve) is linked with this maximum floor surface temperature. $\theta_{F,m} < \theta_{F,\max}$ always applies.

The attainable value $\theta_{F,m}$ depends, not only on the floor heating system, but also on the operating conditions (temperature drop $\sigma = \theta_v - \theta_R$, downward heat flow q_u and heat resistance of the floor covering $R_{\lambda,B}$).

¹⁾ National regulations can limit the temperature to a lower value.

²⁾ Some covering materials can require lower temperatures.

The following assumptions form the basis of the calculation of the heat flow density.

- Heat transfer at the floor surface into the room occurs in accordance with the basic characteristic curve.
- If there is no floor covering ($R_{\lambda,B} = 0$), the downward heat flow density q_u (through the floor) is assumed to be 10 % of the heat flow density upwards q .
- The temperature drop $\sigma = 0$; the dependence of the characteristic curve on the temperature drop is determined by using the logarithmically determined average differential heating medium temperature $\Delta\theta_H$ [3] (see equation (1)).
- Turbulent flow: $m_H/d_i > 4000 \text{ kg/(h}\cdot\text{m)}$.
- There is no lateral heat flow.

5 Documents

Information provided by the system supplier are taken as the basis for the determination of thermal performance. The following documents shall be submitted:

- Installation drawing (section) of the floor heating system covering two pipe spacings, including the external area, giving details of materials used (if necessary, the test results of the materials shall be provided).
- Technical documents for the system.

This information shall contain all necessary details for calculation which are used for installation purposes. They shall be submitted in the same form to the installer.

In the presence of a member of the testing body, a demonstration surface of approximately $2 \text{ m} \times 2 \text{ m}$ shall be laid in order to establish that the construction under test represents the conventional design.

The results of the test are only applicable to the system as tested. Should any changes be made by the supplier of the system relating to any basic elements, a new test shall be necessary.

6 Calculating the heat flow density (characteristic and limit curves)

6.1 General [2], [4]

The heat flow density q at a floor surface is determined by the following parameters.

- Pipe spacing T .
- Thickness s_u and heat conductivity λ_E of the layer above the pipe.
- Thermal conduction resistance $R_{\lambda,B}$ of floor covering.
- Pipe external diameter $D = d_a$, including sheathing ($D = d_M$) if necessary and the heat conductivity of the pipe λ_R and/or the sheathing λ_M . In the case of non-circular pipes, the equivalent diameter of circular pipes having the same circumference is to be calculated (the screed covering shall be used unchanged). The thickness and the thermal conduction resistance of firmly deposited barrier layers up to a thickness of 0,3 mm shall not be taken into consideration. In this case, $D = d_a$ shall be used.
- Heat conducting devices, characterised by the value K_{WL} in accordance with 6.3.
- Contact between the pipes and the heat conducting devices or screed, characterized by the factor a_K .

The heat flow density is proportional to $(\Delta\theta_H)^n$

where the heating medium differential temperature is:

$$\Delta\theta_H = \frac{\theta_V - \theta_R}{\ln \frac{\theta_V - \theta_i}{\theta_R - \theta_i}} \quad (1)$$

and the exponent n , for which experimental and theoretical investigations produce:

$$1,0 < n < 1,05 \quad (2)$$

Within the limits of achievable accuracy, thus

$$n = 1$$

is used.