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Ploskovni sistemi za ogrevanje in hlajenje z vodo - 3. del: Dimenzioniranje

Water based surface embedded heating and cooling systems - Part 3: Dimensioning

Raumflächenintegrierte Heiz- und Kühlsysteme mit Wasserdurchströmung - Teil 3: Auslegung

Systèmes de surfaces chauffantes et rafraîchissantes hydrauliques intégrées - Partie 3 : Dimensionnement

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91.140.10	Sistemi centralnega ogrevanja	Central heating systems

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This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 130.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

This document (prEN 1264-3:2020) 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 document is currently submitted to the CEN Enquiry.

This document will supersede EN 1264-3:2009.

This document, *Water based surface embedded heating and cooling systems*, consists of the following parts:

— *Part 1: Definitions and symbols;*

— *Part 2: Floor heating: Methods for the determination of the thermal output using calculations and experimental tests;*

— *Part 3: Dimensioning;*

— *Part 4: Installation;*

— *Part 5: Determination of the thermal output for wall and ceiling heating and for floor, wall and ceiling cooling.*

The main changes with respect to the previous edition are listed below:

a) Clarification of the scope;

b) Improved wording, especially the term “prove method”;

c) Deleted the Note in 4.1.2.2;

d) Added new subclauses 4.1.3.1, 4.2.3.1, 4.3.3.1 and 5.2.1.1 Pressure loss;

e) Modified the maximum average surface temperature for ceiling heating systems in 4.2.1.4;

f) Replaced Figures 1 and 3 with Figures A.2 and A.3.

1 Scope

EN 1264 covers surface embedded heating and cooling systems installed in buildings, residential and non-residential (e.g. office, public, commercial and industrial buildings) and focuses on systems installed for the purpose of thermal comfort.

EN 1264 applies to water based heating and cooling systems embedded into the enclosure surfaces of the room to be heated or to be cooled. It also applies as appropriate to the use of other heating media instead of water.

EN 1264 applies to identify standardized product characteristics by calculation and testing the thermal output of heating for technical specifications and certification. For the design, construction and operation of these systems, EN ISO 11855 applies.

The systems covered in EN 1264 are adjoined to the structural base of the enclosure surfaces of the building, mounted directly or with fixing supports. It does not cover ceiling systems mounted in a suspended ceiling with a designed open air gap between the system and the building structure which allows the thermally induced circulation of the air. The thermal output of these systems can be determined according to ISO 18566, EN 14037 and EN 14240.

EN 1264-3 deals with the use in practical engineering of the results coming from EN 1264-2 and EN 1264-5.

For heating systems, physiological limitations are taken into account when specifying the surface temperatures. In the case of floor heating systems the limitations are realized by a design based on the characteristic curves and limit curves determined in accordance with EN 1264-2.

For cooling systems, only a limitation with respect to the dew point is taken into account. In predominating practice, this means that physiological limitations are included as well.

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.

EN 1264-1:2019, *Water based surface embedded heating and cooling systems - Part 1: Definitions and symbols*

prEN 1264-2:2019, *Water based surface embedded heating and cooling systems — Part 2: Floor heating: Methods for the determination of the thermal output using calculations and experimental tests*

prEN 1264-4:2019, *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 (all parts), *Heating systems in buildings — Method for calculation of the design heat load*

EN 15243, *Ventilation for buildings — Calculation of room temperatures and of load and energy for buildings with room conditioning systems*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1264-1:2019 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Heating systems

4.1 Floor heating systems

4.1.1 Basic principles

4.1.1.1 Temperature difference between heating water and room

The temperature difference between the heating water and the room is calculated using Formula (1), see also EN 1264-2. In this equation, the effect of the temperature drop of the heating water is taken into account.

$$\Delta\vartheta_H = \frac{\vartheta_V - \vartheta_R}{\ln\dfrac{\vartheta_V - \vartheta_i}{\vartheta_R - \vartheta_i}} \qquad (1)$$

4.1.1.2 Characteristic curve

The characteristic curve describes the relationship between the specific thermal output q of a system and the required temperature difference between heating water and room $\Delta\vartheta_H$. For a simplification, the specific thermal output is taken directly proportional to the temperature difference:

$$q = K_H \cdot \Delta\vartheta_H \qquad (2)$$

where the gradient is the equivalent heat transmission coefficient determined according to part 2 of this European Standard.

4.1.1.3 Field of characteristic curves

The field of characteristic curves of a floor heating system with a specific pipe spacing T shall at least contain the characteristic curves for values of the thermal resistance $R_{\lambda,B} = 0$ (m²·K)/W, $R_{\lambda,B} = 0{,}05$ (m²·K)/W, $R_{\lambda,B} = 0{,}10$ (m²·K)/W and $R_{\lambda,B} = 0{,}15$ (m²·K)/W in accordance with part 2 of this European Standard (see Figure A.1). Values of $R_{\lambda,B} > 0{,}15$ (m²·K)/W shall not be used if possible.

4.1.1.4 Limit curves

The limit curves in the field of characteristic curves describe in accordance with part 2 of this European Standard the relationship between the specific thermal output q and the temperature difference $\Delta\vartheta_H$ between the heating water and the room in the case where the physiologically agreed limit values of surface temperatures $\vartheta_{F,max} = 29$ °C (occupied area) or $\vartheta_{F,max} = 35$ °C (peripheral area) are reached[1]. For bathrooms ($\vartheta_I = 24$ °C) the limit curve for ($\vartheta_{F,max} - \vartheta_i$) = 9 K also applies. For design purposes, i.e. the determination of design values of the specific thermal output and the associated temperature difference between heating water and room, the limit curves are valid for the temperature drop σ of the heating water in a range of

$0\ \text{K} < \sigma \leq 5\ \text{K}$

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[1] National regulations may limit these temperatures to lower values.

The limit curves are used to specify the maximum permissible flow temperature (see Clause 4.1.3.2 and Figure A.2).

4.1.1.5 Thermal inertia

The difference between the minimum and the maximum surface temperature of a floor heating system is low. This means for design purposes that no consideration of thermal inertia is required.

4.1.2 Boundary conditions

4.1.2.1 Flow pipes to adjacent rooms

The heat output of service pipes, not serving rooms through which they pass, shall be limited by careful design, or by use of thermal insulation coverings, so that any room temperature should not be increased substantially. The heat output of service pipes passing through the room in question to adjacent rooms is taken into account if the same type of room usage can be assumed.

4.1.2.2 Thermal insulation

To limit the heat flow through the floor to rooms below, the required thermal resistance of the insulating layer $R_{\lambda,\mathrm{ins}}$ (see Figure A.3) shall be at minimum in accordance with of EN 1264-4[2)], Table 1. It is calculated according to Formula (3).

$$R_{\lambda,\mathrm{ins}} = \frac{s_{\mathrm{ins}}}{\lambda_{\mathrm{ins}}} \qquad (3)$$

where

s_{ins} is the thickness of the insulating layer in m;

λ_{ins} is the thermal conductivity of the insulating layer in W/(m·K).

Depending on the construction of the floor heating system, the effective thickness of the insulating layer s_{ins} is determined differently:

For floor heating systems with flat thermal insulating panels (see Figure 1), s_{ins} is identical with the thickness of the thermal insulating panel.

For floor heating systems with profiled thermal insulating panels (see Figure 3), a surface-related weighted calculation is made for the effective thickness of the insulating layer s_{ins}:

$$s_{\mathrm{ins}} = \frac{s_{\mathrm{h}} \cdot (T - D) + s_{\mathrm{l}} \cdot D}{T} \qquad (4)$$

For profiled thermal insulating panels shaped differently from that shown in Figure 3, the average effective thickness of the insulating layer shall be calculated with an accordant application of Formula (4).

The thermal resistance $R_{\lambda,\mathrm{ins}}$ of the insulating layers of the heating/cooling system shall be calculated as reported in EN 1264-4, Table 1.

This calculation can be done with the assumption that the thermal insulation is continuous parallel to the pipes. If the thermal insulation is not continuous (see Figure 2), a measurement shall be done.

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2) National regulations may vary the requirements given in Table 1 of EN 1264-4.

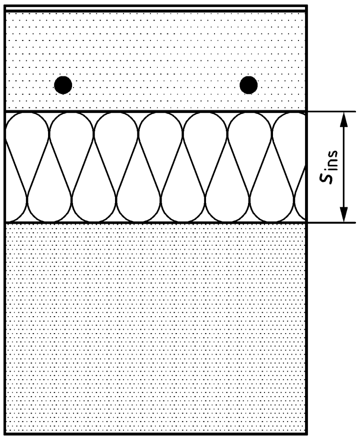
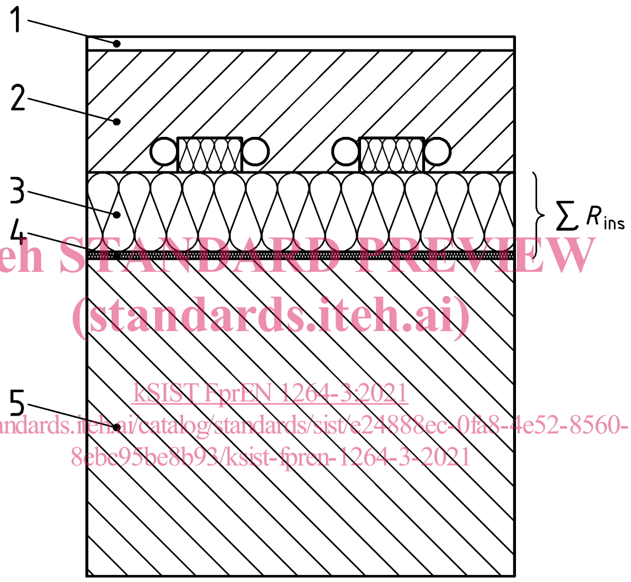


Figure 1 — Average thickness of insulating layer flat insulating panels



Key

1 Floor covering

2 Weight bearing and thermal diffusion layer

3 Thermal insulation with studs

4 Acoustic insulation (if present)

5 Structural base

Figure 2 — Type A and Type C. System with studs

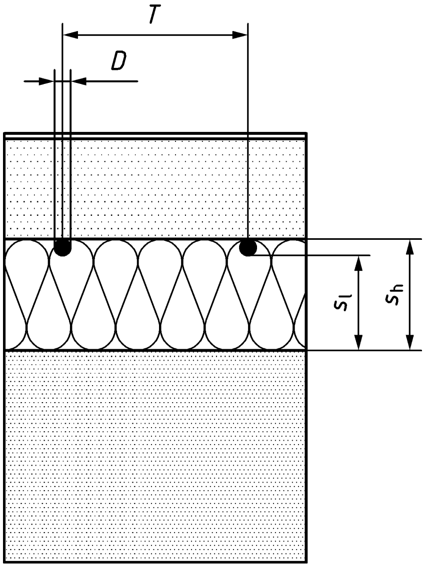


Figure 3 — Average thickness of insulating for layer for profiled insulating panels

4.1.3 Design

4.1.3.1 Pressure loss

The maximum pressure loss per heating circuit should not exceed 250 mbar in order to limit the electrical power consumption of the pump, e.g. by hydronic balancing (see prEN 1264-2:2019, 4.1).

4.1.3.2 Design value of specific thermal output

The design value q_{des} to design a floor heating system for a room is equal to the standard heat load $Q_{N,f}$ (see part 1 of this Standard) divided by the heating surface A_F:

$$q_{des} = \frac{Q_{N,f}}{A_F} \quad (5)$$

The standard heat load $Q_{N,f}$ shall be calculated in accordance with EN 12831 (all parts). Normally, the heat output Q_F of the floor heating system shall be equivalent to the standard heat load $Q_{N,f}$. If this is not possible, additional heating surfaces shall be used, see Formula (12).

The design thermal output Q_F of the entire heating surface A_F is calculated using Formula (6):

$$Q_F = q \cdot A_F \quad (6)$$

Where peripheral area is used, q shall be distributed between the peripheral area A_R and the occupied area A_A according to a surface weighted calculation (see also Clause 4.1.4):

$$q = \frac{A_R}{A_F} \cdot q_R + \frac{A_A}{A_F} \cdot q_A \quad (7)$$

where:

q_A is the specific thermal output of the occupied area;

q_R is the specific thermal output of the peripheral area.

4.1.3.3 Determination of the design flow temperature

The design flow temperature is determined for the room (or the rooms respectively) with the maximum specific thermal output $q_{max} = q_{des}$ (excluding bathrooms). In the rooms being heated, it is assumed that floor coverings with a uniform thermal conduction resistance are used. Generally for the design of floor heating systems in residential rooms, uniform floor coverings with $R_{\lambda,B} = 0{,}10\ (m^2 \cdot K)/W$ are assumed. In the case of using higher values $R_{\lambda,B}$, these values shall be taken.

For the room used for design, the temperature drop of the heating water is specified to $\sigma \leq 5$ K. If necessary, a subdivision of this room into heating circuits should be performed. Under these conditions, the maximum value q_{max} may reach until the limit value q_G of the specific thermal output (see Figure A.2)[3)].

For the room with q_{max}, a pipe spacing is chosen with which q_{max} remains less or equal to the limit value q_G ($q_{max} \leq q_G$, see Figure A.2). For this, small pipe spacing is recommended. In case of $q_{max} \leq q_G$, design values of the temperature difference between flow heating water and room $\Delta\vartheta_{V,des} \leq \Delta\vartheta_{H,G} + 2{,}5$ K are permitted (see Figure A.2). The maximum permissible temperature difference between flow and room comes to:

$$\Delta\vartheta_{V,des} = \Delta\vartheta_{H,des} + \frac{\sigma}{2} \text{ where } \Delta\vartheta_{H,des} \leq \Delta\vartheta_{H,G} \tag{8}$$

Formula (8) applies if $\sigma/\Delta\vartheta_H \leq 0{,}5$. If $\sigma/\Delta\vartheta_H > 0{,}5$, Formula (9) applies:

$$\Delta\vartheta_{V,des} = \Delta\vartheta_{H,des} + \frac{\sigma}{2} + \frac{\sigma^2}{12 \cdot \Delta\vartheta_{H,des}} \tag{9}$$

The temperature drop σ in Formula (8) and in Formula (9), in Figure A.2 is designated σ_{des}.

The result of Formula (8) or Formula (9) provides the design flow temperature $\vartheta_{V,des} = \Delta\vartheta_{V,des} + \vartheta_i$.

For all other rooms operated at the same flow temperature $\vartheta_{V,des}$, for $\sigma/\Delta\vartheta_{H,j} \leq 0{,}5$ the associated the temperature drops σ_j of the heating water are taken from the field of characteristic curves (see Figure A.2) or calculated according to

$$\frac{\sigma_j}{2} = \Delta\vartheta_{V,des} - \Delta\vartheta_{H,j} \tag{10}$$

using the temperature differences $\Delta\vartheta_{H,j}$ corresponding to the respective values of the specific thermal output q_j (see Figure A.2).

For $\sigma/\vartheta_{H,j} > 0{,}5$ the temperature drop σ_j has to be calculated using Formula (11):

$$\sigma_j = 3 \cdot \Delta\vartheta_{H,j} \cdot \left[\left(1 + \frac{4 \cdot \left(\Delta\vartheta_{V,des} - \Delta\vartheta_{H,j} \right)}{3 \cdot \Delta\vartheta_{H,j}} \right)^{\frac{1}{2}} - 1 \right] \tag{11}$$

3) This means that above the flow pipe the maximum floor temperature $\vartheta_{F,max}$ can be exceeded compared with the centre of the room, corresponding to the higher heating water temperature by $\sigma/2$.