SLOVENSKI STANDARD
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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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ICS:

91.140.10	Sistemi centralnega ogrevanja	Central heating systems

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English Version

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

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This European Standard was approved by CEN on 12 April 2021.

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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 (EN 1264-3:2021) 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of an identical text or by endorsement, at the latest by November 2021, and conflicting national standards shall be withdrawn at the latest by November 2021.

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

This document supersedes EN 1264-3:2009.

The main changes compared to the previous edition are listed below:

a) Clarification of the Scope;

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

c) Deletion of the Note in 4.1.2.2;

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

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

f) Figures 1 and 3 replaced with Figures A.2 and A.3;

g) Correction of Formula (15) from $1/\alpha = 0{,}009\ 3\ (m^2 \cdot K)/W$ to $1/\alpha = 0{,}092\ 6\ (m^2 \cdot K)/W$.

EN 1264, *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.*

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

The EN 1264 series gives guidelines for 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.

The EN 1264 series gives guidelines for water based heating and cooling systems embedded into the enclosure surfaces of the room to be heated or to be cooled. It also specifies the use of other heating media instead of water, as appropriate.

The EN 1264 series specifies 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, see EN 1264-3 and EN 1264-4 for the types A, B, C, D, H, I and J. For the types E, F and G, see the EN ISO 11855 series.

The systems specified in the EN 1264 series are adjoined to the structural base of the enclosure surfaces of the building, mounted directly or with fixing supports. The EN 1264 series does not specify 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 EN 14037 series and EN 14240.

EN 1264-3 specifies 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 1264-1:2021, *Water based surface embedded heating and cooling systems — Part 1: Definitions and symbols*

EN 1264-2:2021, *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*

EN 1264-4:2021, *Water based surface embedded heating and cooling systems — Part 4: Installation*

EN 1264-5:2021, *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 1264-1:2021 apply.

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

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

— IEC Electropedia: available at https://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 Formula, the effect of the temperature drop of the heating water is taken into account.

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

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, see Formula (2):

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

where the gradient is the equivalent heat transmission coefficient determined according to EN 1264-2.

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 EN 1264-2 (see Figure A.1, in Annex A). 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 EN 1264-2 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:

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

The limit curves are used to specify the maximum permissible flow temperature (see 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 $R_{\lambda,ins}$ (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).

$$R_{\lambda,ins} = \frac{s_{ins}}{\lambda_{ins}} \tag{3}$$

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.

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1 National regulations may limit these temperatures to lower values.

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

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}:

$$s_{ins} = \frac{s_h \cdot (T - D) + s_l \cdot D}{T} \quad (4)$$

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 $R_{\lambda,ins}$ of the insulating layers of the heating/cooling system shall be calculated as reported in EN 1264-4:2021, Table 1.

This calculation can be done with the assumption that the thermal insulation is continuous parallel to the pipes. For floor heating systems with thermal insulation panels with studs according to Figure 2 (Type A and Type C systems), only the flat part of the panel (without studs) shall be considered in calculation of s_{ins}.

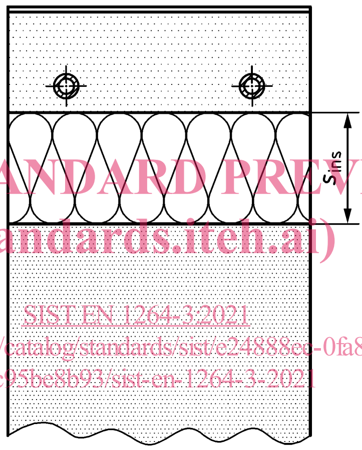
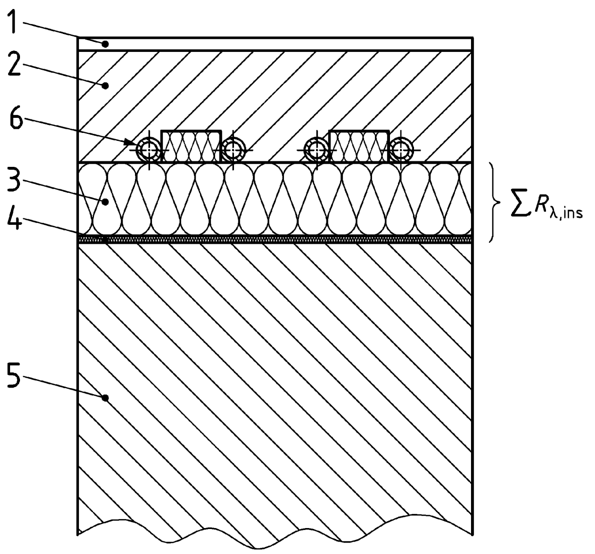


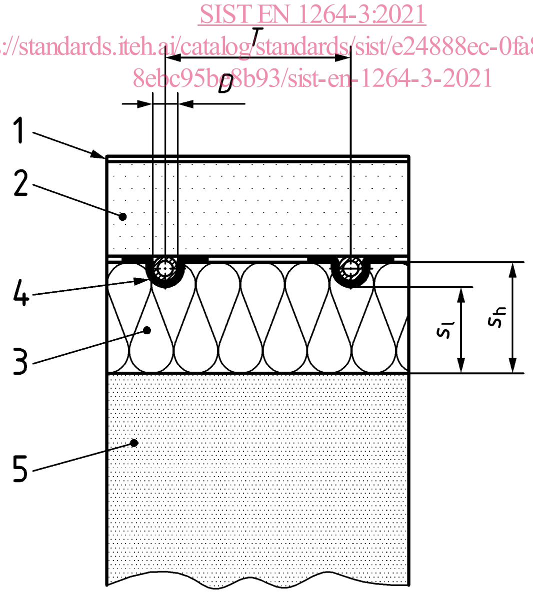
Figure 1 — Average thickness of insulating layer flat insulating panels



Key

1 floor covering
2 weight bearing and thermal diffusion layer
3 thermal insulation with studs
4 acoustic insulation (if present)
5 structural base
6 pipes

Figure 2 — Type A and Type C System with studs



Key

1 floor covering
2 weight bearing and thermal diffusion layer
3 thermal insulation
4 heat diffusion device
5 structural base

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 be minimized in order to limit the electrical power consumption of the pump, e.g. by hydronic balancing (see EN 1264-4:2021, 4.1). It should not exceed 350 mbar.

4.1.3.2 Design 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 EN 1264-1) 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 Formula (7) (see also 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 $R_{\lambda,B} = 0{,}10$ (m²·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].

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[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 $\sigma/2$.