BS EN 1264-1:2011

BSI Standards Publication

Water based surface embedded heating and cooling systems

Part 1: Definitions and symbols

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National foreword

This British Standard is the UK implementation of EN 1264-1:2011. It supersedes BS EN 1264-1:1998 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee RHE/6, Air or space heaters or coolers without combustion.

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.

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

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English Version

Water based surface embedded heating and cooling systems - Part 1: Definitions and symbols

Systèmes de surfaces chauffantes et rafraîchissantes hydrauliques encastrées - Partie 1: Définitions et symboles

Raumflächenintegrierte Heiz- und Kühlsysteme mit Wasserdurchströmung - Teil 1: Definitionen und Symbole

This European Standard was approved by CEN on 3 June 2011.

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Foreword

This document (EN 1264-1:2011) 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of an identical text or by endorsement, at the latest by December 2011, and conflicting national standards shall be withdrawn at the latest by December 2011.

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

This document supersedes EN 1264-1:1997.

The series of European Standards EN 1264 "*Water based surface embedded heating and cooling systems*" consists of the following parts:

— Part 1: Definitions and symbols;

— Part 2: Floor heating: Prove methods for the determination of the thermal output using calculation and test methods;

— Part 3: Dimensioning;

— Part 4: Installation;

— Part 5: Heating and cooling surfaces embedded in floors, ceilings and walls — Determination of the thermal output.

The main change with respect to EN 1264-1:1997 consists in the expansion of the scope over floor heating, now additionally includes ceiling and wall heating as well as cooling surfaces in floors, ceilings and walls.

According to the CEN/CENELEC Internal Regulations, the national standards organizations 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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard is applicable to water based surface embedded heating and cooling systems in residential, office and other buildings, the use of which corresponds to or is similar to that of residential buildings.

This European Standard applies to 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.

2 Normative references

The following referenced documents are indispensable for the application 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 1264-3:2009, *Water based surface embedded heating and cooling systems — Part 3: Dimensioning*

3 Terms and Definitions

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

3.1 Surface embedded heating and cooling system

3.1.1
surface embedded heating and cooling system
heating or cooling installation embedded into the enclosure surfaces of the room consisting of circuits of pipes, circuit distributors, and control equipment

3.1.2
floor, wall, ceiling heating and cooling system
system where pipes carrying water with or without additives as a heating or cooling medium are laid in the floor, wall or ceiling

3.1.3
circuit
section of pipes connected to circuit distributor which can be independently switched and controlled

3.1.4
circuit distributor
common connection point for several circuits

3.1.5
system components
- insulating layer for thermal and footstep noise insulation,
- protection layer (to protect the insulating layer),
- heating/cooling pipes or plane sections,
- floor covering,
- heat diffusion devices, peripheral strips, attachment items etc.,

- weight bearing layer consisting of screed or timber, for type B systems,

- weight bearing and thermal diffusion layer consisting of screed, for type A, type C and type D systems,

NOTE The components may be different depending on the system

3.1.6
types of heating/cooling structures

3.1.6.1
systems with pipes inside the screed type A and type C
systems with heating/cooling pipes completely embedded in the screed

NOTE See Figure A.1 and A.3.

3.1.6.2
systems with pipes below the screed type B
systems with heating/cooling pipes laid with diffusion plates in the thermal insulating layer below the screed

NOTE See Figure A.2.

3.1.6.3
systems with surface elements (plane sections) type D
system plates with hollow sections acting as water channels

NOTE See Figure A.4.

3.1.7
system Insulation
insulation with the thermal resistance $R_{\lambda,ins}$ according to EN 1264-4:2009, Table 1 to limit the heat loss of heating and cooling systems

NOTE In the case of floor heating and cooling systems, as a rule the thermal resistance $R_{\lambda,ins}$ is provided by the insulation layers which are integral parts of the system; on this topic, national rules shall be consulted. In the case of wall and ceiling heating and cooling systems, the thermal resistance $R_{\lambda,ins}$ may be determined taking into account the effective thermal resistance of the building structure.

3.1.8
interior walls
partitions of rooms within dwellings or similar used room groups

NOTE Wall heating and cooling systems embedded in interior walls, are constructed with or without insulation, depending on their use.

3.2 Supplementary heating equipment

Additional heating facility, e. g. convectors, radiators with the additional required thermal output and possibly with its own control equipment

3.3 Parameters of design

3.3.1
standard heat load in a floor heated room
$Q_{N,f}$
rate of heat loss from the building to the outside and to neighbouring rooms under standardized conditions, depending on the regional climatic data, the location, its use and the thermal properties of the building

NOTE When calculating the standard heat load, the thermal output from the embedded heating systems in the neighbouring room is not taken into account.

3.3.2
standard cooling load
$Q_{C,f}$
rate of heat input into the building from the external environment and neighbouring rooms under standardized conditions and depending on the regional climatic data, location, its use and thermal properties of the building

3.3.3
additional thermal output
Q_{out}
thermal output of supplementary heating equipment

NOTE $Q_{out} = Q_{N,f} - Q_F$

3.3.4
heating/cooling surface
A_F
area of surface covered by the heating or cooling system, including a perimeter strip whose width should be half of one spacing, but not exceeding 0,150 m

3.3.5
furniture area
area of the floor surface not covered by a heating or cooling system, intended for permanent placement of furnishings forming part of the building

3.3.6
peripheral area
A_R
floor surface heated to a higher temperature and generally an area of 1,0 m maximum in width along exterior walls.

NOTE It is not an occupied area.

3.3.7
occupied area
A_A
area within the heated or cooled floor surface occupied for long periods

NOTE In case of floor heating, it consists of the heating floor surface less the peripheral area.

3.3.8
standard indoor room temperature
ϑ_i
resultant indoor temperature defined as the average of the dry air temperature and the mean radiant temperature

NOTE The resultant temperature is considered as the relevant for thermal comfort assessment and heat loss calculations. This value of internal temperature is used for the calculation method [1], [2].

3.3.9
regional dew point
$\vartheta_{Dp,R}$
dew point specified depending on the climatic conditions of the region

3.3.10
design dew point
$\vartheta_{Dp,des}$
dew point determined for the design

3.4 Thermal output

3.4.1
specific thermal output of floor heating systems
q
thermal output of floor heating systems divided by the surface area

3.4.2
specific thermal output of embedded heating systems
q_H
thermal output of embedded heating systems divided by the surface area

NOTE For floor heating, index H is not used.

3.4.3
specific thermal output of embedded cooling systems
q_C
thermal output of embedded cooling systems divided by the surface area

3.4.4
limit of specific thermal output of floor heating systems
q_G
specific thermal output at which the permissible maximum floor surface temperature is achieved

NOTE In the case of floor heating, this means the maximum value of surface temperature $\vartheta_{F,max}$ within the range of temperature distribution.

3.4.5
maximum limit of specific thermal output of floor heating systems
$q_{G,max}$
limit of specific thermal output of floor heating systems, calculated in accordance with the Basic Characteristic Curve due to maximum floor surface temperature $\vartheta_{F,max}$ together with isothermal surface temperature distribution

3.4.6
standard thermal output of floor heating systems
q_N
limit of specific thermal output of floor heating systems achieved without floor covering

3.4.7
standard specific thermal output of embedded heating systems
$q_{H,N}$
specific thermal output of embedded heating systems achieved with standard temperature difference between heating medium and room

NOTE For heating systems (other then floor heating), $\Delta\vartheta_{H,N}$ = 10 K is valid.

3.4.8
standard specific thermal output of embedded cooling systems
$q_{C,N}$
specific thermal output of embedded cooling systems achieved with standard temperature difference between room and cooling medium

NOTE For cooling systems, $\Delta\vartheta_{C,N}$ = 8 K is valid.

3.4.9
design value of specific thermal output of floor heating systems
q_{des}
amount due to the room, calculated with the standard heat load, divided by the heating floor surface area

3.4.10
maximum value of specific thermal output
q_{max}
highest design value q_{des} within q_G of specific thermal output in circuits operated at the same design flow temperature

3.4.11
downward specific heat loss of floor heating systems
q_u
specific thermal output throughout the floor construction, to rooms beyond, the ground or cold void

3.4.12
design thermal output of floor heating systems
Q_F
sum of thermal output based on output of each area in relation to the total room floor area

3.4.13
design value of specific cooling load
$q_{C,Ld,des}$
standard cooling load divided by the cooling surface

3.4.14
design specific thermal output of cooling systems
$q_{C,des}$
value of specific thermal output achieved with design value of average temperature difference between room and cooling medium

3.5 Surface temperatures

3.5.1
maximum floor surface temperature
$\vartheta_{F,max}$
maximum temperature permissible for physiological reasons, for calculation of the limit curves, which may occur at a point on the floor in the occupied or peripheral area

NOTE $\vartheta_{F,max}$ limits the thermal output. In this case the highest point surface temperature on the floor need to be taken.

3.5.2
average surface temperature
$\vartheta_{F,m}$
average temperature value for each heated surface area, such as occupied or peripheral heated floors

NOTE With the exception of floor heating, the limit of thermal output is identified by maximum value (heating systems) or minimum value (cooling systems) of $\vartheta_{F,m}$.

3.5.3
average temperature difference between surface and room
difference $\vartheta_{F,m}$ - ϑ_i between the average temperature of the heating or cooling surface and the standard indoor room temperature

NOTE This determines the specific thermal output for heating and cooling.

3.6 Temperatures of the heating/cooling medium

NOTE In this standard series, the denotations medium and water are used as synonym.

3.6.1
temperature difference between heating medium and room
$\Delta\vartheta_H$
average difference between the temperatures of the heating medium and the standard indoor room temperature determined in a logarithmic equation

NOTE See EN 1264-2:2008, equation (1) .

3.6.2
limit value of temperature difference between heating medium and room
$\Delta\vartheta_{H,G}$
temperature difference between heating medium and room at which the permissible maximum floor surface temperature is achieved

NOTE $\Delta\vartheta_{H,G}$ is determined by the specific thermal output q_G, see EN 1264-2:2008, equation (20)

3.6.3
standard temperature difference between heating medium and room for floor heating systems
$\Delta\vartheta_N$
limit value of temperature difference $\Delta\vartheta_{H,G}$ between heating medium and room floor heating systems without floor covering

NOTE $\Delta\vartheta_N$ is determined by the standard specific thermal output q_N.

3.6.4
standard temperature difference between heating medium and room for heating systems with the exception of floor heating
$\Delta\vartheta_{H,N}$
standard value set at 10 K

3.6.5
design temperature difference between heating medium and room of floor heating systems
$\Delta\vartheta_{H,des}$
value of temperature difference between heating medium and room taking into account the thermal resistance of the chosen floor covering, at q_{max}

3.6.6
heating circuit design temperature difference between heating medium and room of floor heating systems
$\Delta\vartheta_{H,j}$
value of temperature difference between heating medium and room with the thermal resistance of the chosen floor covering, at a required value of specific thermal output q_j which is less than maximum value of specific thermal output q_{max}

3.6.7
design temperature difference between flow of heating medium and room of floor heating systems
$\Delta\vartheta_{V,des}$
value of temperature difference between flow of heating medium and room with the thermal resistance of the chosen floor covering, at maximum value of specific thermal output q_{max}

3.6.8
design flow temperature of floor heating systems
$\vartheta_{V,des}$
value of flow water temperature with the thermal resistance of the chosen floor covering, at maximum value of specific thermal output q_{max}

NOTE The flow temperature and the supply temperature are the same throughout the standard series EN 1264.

3.6.9
average temperature of heating medium
ϑ_{H}
calculated temperature deduced from the standard room temperature plus the temperature difference between heating medium and room

3.6.10
temperature drop of heating medium
σ
difference between the flow and return temperatures of the medium

NOTE The denotation σ also is used for design value in case of q_{max}.

3.6.11
heating circuit design temperature drop of heating medium
σ_j
value of temperature drop of heating medium at a required value of specific thermal output q_j which is less than maximum value of specific thermal output q_{max}

3.6.12
temperature difference between room and cooling medium for cooling systems
$\Delta\vartheta_{C}$
average difference between the standard indoor room temperature and the cooling medium temperature, determined in a logarithmic equation

NOTE See EN 1264-3:2009, equation (16).

3.6.13
standard temperature difference between room and cooling medium for cooling systems
$\Delta\vartheta_{C,N}$
standard value set at 8 K

3.6.14
inlet (flow) water temperature of cooling systems
$\vartheta_{C,in}$
inlet (flow) temperature of cooling water in a cooling circuit

3.6.15
design inlet (flow) water temperature of cooling systems
$\vartheta_{C,in,des}$
permissible inlet (flow) temperature of cooling water, depending on design dew point

3.6.16
outlet (return) water temperature of cooling systems
$\vartheta_{C,out}$
outlet (return) temperature of cooling water in a cooling circuit

3.6.17
design temperature difference between room and cooling medium
$\Delta\vartheta_{C,des}$
permissible average difference between room and cooling medium depending on permissible design flow temperature and temperature rise of cooling medium

3.6.18
average temperature of cooling medium
ϑ_C
arithmetic mean of inlet (flow) and outlet (return) water temperature

3.6.19
temperature rise of cooling medium
σ_C
difference between outlet (return) and inlet (flow) temperature of the medium in a circuit

NOTE The denotation σ_C is also used for design value.

3.7 Flow rates

3.7.1
heating mode - design water flow rate
m_H
mass flow rate in a heating circuit which is required to achieve the design value of specific thermal output

NOTE The denotation design heating water flow rate also is used.

3.7.2
cooling mode – design water flow rate
m_C
mass flow rate in a cooling circuit which is required to achieve the design value of specific thermal output

NOTE The denotation design cooling water flow rate also is used.

3.8 Characteristic curves

3.8.1
basic characteristic curve
curve describing the relationship between the specific thermal output q and the average temperature difference between the surface and the room ($\vartheta_{F,m}$ - ϑ_i), and is applicable to all hot water floor heating systems

3.8.2
field of characteristic curves
curves describing the system-specific relationship between the specific thermal output and the required temperature difference $\Delta\vartheta_H$ for heating systems or $\Delta\vartheta_C$ for cooling systems, for heat resistance of various surface coverings

3.8.3
limit curves
curves representing the maximum heat output limits q_G and the temperature difference between the heating medium and the room $\Delta\vartheta_{H,G}$ for various floor surface coverings

4 Symbols

The symbols of Table 1 are used in all parts of EN 1264.

Table 1 – Symbols used in all parts of EN 1264

Symbol	Unit	Quantity
A_A	m^2	Surface area of the occupied area
A_F	m^2	Surface area of the heating/cooling area
A_R	m^2	Surface area of the peripheral area
a_i	-	Parameters (calculated or taken from tables) for the calculation of characteristic curves and depending on floor construction, i = B, D, k, T, u, WL
B, B_0	$W/(m^2 \cdot K)$	System-dependent coefficients for calculation of characteristic curves
B_G	$W/(m^2 \cdot K)$	System-dependent coefficient for calculation of limit curves
b_u	-	Calculated factor for type B systems depending on the pipe spacing
c_W	kJ/(kg·K)	Specific heat capacity of water
D	m	External diameter of the pipe, including sheathing where applicable
d_a	m	Pipe external diameter
d_i	m	Pipe internal diameter
d_M	m	External diameter of sheathing
f_G	-	Factor to calculate limit curves for type A and type C systems, depending on parameter s_u/T
K_H	$W/(m^2 \cdot K)$	Equivalent heat transmission coefficient represented by the gradient of characteristic curve
K_{WL}	-	Parameter of heat diffusion devices for type B systems
L	m	Width of heat diffusion devices
m_H	kg/s	Design heating medium flow rate

Table 1 (continued)

m_i		Exponents for calculation of characteristic curves, i = m_D, m_T, m_u
n		Exponent for the temperature difference of a characteristic curve
n_G		Exponent for the temperature difference of a limit curve
$Q_{C,f}$	W	Standard cooling load
Q_F	W	Design thermal output of floor heating systems
$Q_{N,f}$	W	Standard heat load of a floor heated room
Q_{out}	W	Additional required thermal output
q	W/m^2	Specific thermal output of floor heating systems
q_A	W/m^2	Specific thermal output of the occupied area
q_C	W/m^2	Specific thermal output of embedded cooling systems
$q_{C,Ld,des}$	W/m^2	Designed specific cooling load
$q_{C,N}$	W/m^2	Standard specific thermal output of embedded cooling systems
q_{des}	W/m^2	Design value of specific thermal output of floor heating systems
q_G	W/m^2	Limit of specific thermal output
$q_{G,M,s(R\lambda;B=0,15)}$	W/m^2	Result for q_G in the case of $R_{\lambda;B}$ = 0,15, for proving of reproducibility precision
$q_{G,max}$	W/m^2	Maximum limit of specific thermal output of floor heating systems
q_H	W/m^2	Specific thermal output of embedded heating systems, excluding floor heating
$q_{H,N}$	W/m^2	Standard specific thermal output of embedded heating systems, excluding floor heating
q_j	W/m^2	Specific thermal output in rooms with $q < q_{max}$, operated at the same value $\vartheta_{V,des}$
q_{max}	W/m^2	Highest value of specific thermal output in circuits operated with the same value of $\vartheta_{V,des}$

Table 1 (continued)

q_N	W/m^2	Standard thermal output of floor heating systems
$q_{N,M,s}$	W/m^2	Result for q_N, for proving of reproducibility precision
q_R	W/m^2	Specific thermal output of the peripheral area
q_u	W/m^2	Downward specific heat loss of floor heating systems
R_{HFM}	m^2·K/W	Thermal resistance of the heat flow meter plate
R_o	m^2·K/W	Upwards partial heat transmission resistance of the floor structure
R_u	m^2·K/W	Downwards partial heat transmission resistance of the floor structure
R_α	m^2·K/W	Heat exchange resistance on the heating surface
$R_{\alpha,back}$	m^2·K/W	Heat exchange resistance on the surface of the back side of a wall
$R_{\alpha,floor}$	m^2·K/W	Heat exchange resistance on the floor above the ceiling heated room
$R_{\alpha,ceiling}$	m^2·K/W	Heat exchange resistance on the ceiling under the floor heated room
$R_{\lambda,B}$	m^2·K/W	Heat resistance of floor covering Effective thermal resistance of carped covering
$R_{\lambda,B,M,s}$	m^2·K/W	Result for effective thermal resistance of carped covering, for proving of reproducibility precision
$R_{\lambda,ceiling}$	m^2·K/W	Heat resistance of the ceiling construction below insulation layer
$R_{\lambda,ins}$	m^2·K/W	Heat resistance of thermal insulation
$R_{\lambda,plaster}$	m^2·K/W	Heat resistance of plaster
ΔR_α	m^2·K/W	Additional thermal transfer resistance compared with floor heating
s_h	m	In Type B systems, the overall thickness of thermal insulation (see EN 1264-3:2009, Figure A.3)

Table 1 (continued)

s_I	m	In Type B systems, the overall thickness of thermal insulation less heating pipe diameter (see EN 1264-3:2009, Figure A.3)
s_{ins}	m	Thickness of thermal insulation
s_0	-	Tolerance for repeatability precision
s_m	-	Tolerance for reproducibility precision
s_R	m	Pipe wall thickness
s_u	m	Thickness of the layer (screed, timber) above the pipe
s_{WL}	m	Thickness of heat diffusion device
T	m	Pipe spacing
α	W/(m^2·K)	Heat exchange coefficient
$1/\alpha$	m^2 K/W	Heat exchange resistance
$\vartheta_{C,in}$	°C	Inlet flow water temperature of cooling systems
$\vartheta_{C,in,des}$	°C	Design inlet flow water temperature of cooling systems
$\vartheta_{C,out}$	°C	Outlet return water temperature of cooling systems
$\vartheta_{F,m}$	°C	Average surface temperature
$\vartheta_{F,max}$	°C	Maximum floor surface temperature
ϑ_{Gl}	°C	Ambient reference temperature measured with globe thermometer
ϑ_H	°C	Average temperature of the heating medium
$\vartheta_{HFM,a}$	°C	Temperature of the surface on top of the heat flow meter plate
$\vartheta_{HFM,b}$	°C	Temperature of the surface at the bottom of the heat flow meter plate
ϑ_i	°C	Standard indoor room temperature
$\vartheta_{F,j}$	°C	Localized floor surface temperature

Table 1 (continued)

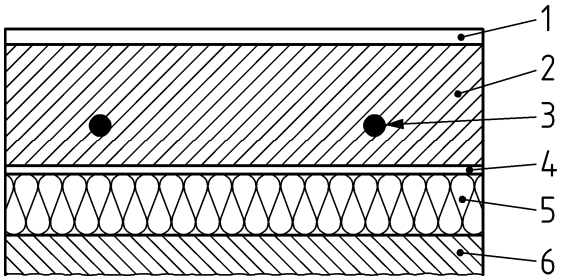
ϑ_R	°C	Return temperature of heating medium
ϑ_V	°C	Flow (supply) temperature of heating medium
$\vartheta_{V,des}$	°C	Design flow water temperature of floor heating systems, determined by room with q_{max}
ϑ_u	°C	Temperature in a room under the floor heated room
$\Delta\vartheta_C$	K	Temperature difference between room and cooling medium for cooling systems
$\Delta\vartheta_{C,N}$	K	Standard temperature difference between room and cooling medium for cooling systems
$\vartheta_{Dp,R}$	°C	Regional dew point
$\vartheta_{Dp,R0}$	°C	Specified value of regional dew point
$\vartheta_{Dp,des}$	°C	Design dew point
$\Delta\vartheta_H$	K	Temperature difference between heating medium and room
$\Delta\vartheta_{H,des}$	K	Design temperature difference between heating medium and room of floor heating systems
$\Delta\vartheta_{H,G}$	K	Limit value of temperature difference between heating medium and room for floor heating systems
$\Delta\vartheta_{H,j}$	K	Heating circuit design temperature difference between heating medium and room of floor heating systems determined by q_j, in circuits operated at the same value $\vartheta_{V,des}$
$\Delta\vartheta_{H,N}$	K	Standard temperature difference between heating medium and room for heating systems, with the exception of floor heating
$\Delta\vartheta_{C,N}$	K	Standard temperature difference between room and cooling medium for cooling systems
$\Delta\vartheta_N$	K	Standard temperature difference between heating medium and room for floor heating systems
$\Delta\vartheta_V$	K	Temperature difference between flow temperature and standard room temperature
$\Delta\vartheta_{V,des}$	K	Design temperature difference between flow of heating medium and room of floor heating systems, determined by room with q_{max}

Table 1 (continued)

λ_E	W/(m·K)	Heat conductivity of the layer (screed, timber) above the pipe
λ_{ins}	W/(m·K)	Heat conductivity of the insulating layer
λ_M	W/(m·K)	Heat conductivity of the sheathing material
λ_R	W/(m·K)	Heat conductivity of the pipe material
λ_{WL}	W/(m·K)	Heat conductivity of the heat diffusion device material
σ	K	Temperature drop of heating medium ϑ_V - ϑ_R in general, but also used for design value in case of room circuit with q_{max}, operated at $\vartheta_{V,des}$
σ_c	K	Temperature rise of cooling medium in general, but also used for design value
σj	K	Heating circuit design temperature drop of heating medium in rooms with $q_j < q_{max}$, operated at the same value $\vartheta_{V,des}$
$\phi_{M,s}$	-	Summary abbreviation for $q_{G,M,s}$($R_{\lambda;B}$=0,15), $q_{N,M,s}$, $R_{\lambda,B,M,s}$
$\phi_{0,s}$	-	Laboratories results for determination of $\phi_{M,s}$
φ	-	Conversion factor for temperature differences
ψ	-	Content by volume of the pipe fixing material in the screed

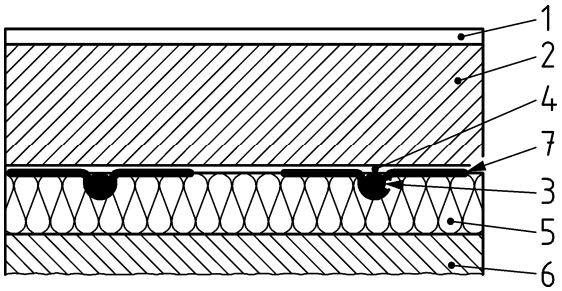
Annex A
(normative)

Figures



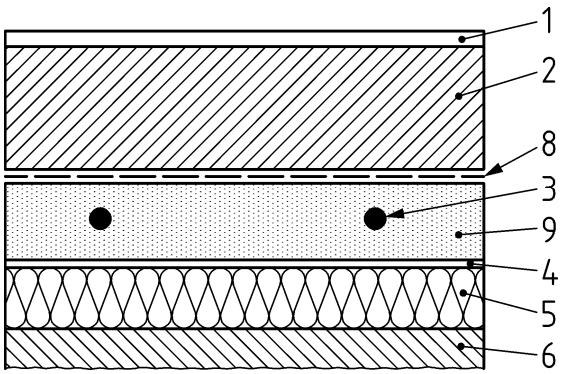
1 = floor covering
2 = weight bearing and thermal diffusion layer (screed)
3 = heating/cooling pipe
4 = protection layer
5 = insulating layer
6 = structural base

Figure A.1 — Systems with pipes inside the screed type A



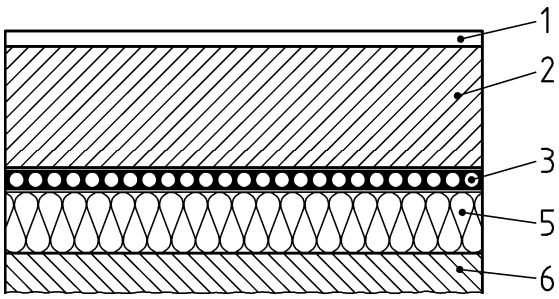
1 = floor covering
2 = weight bearing layer (timber/screed)
3 = heating/cooling pipe
4 = protection layer
5 = insulating layer
6 = structural base
7 = heat diffusion device

Figure A.2 — Systems with pipes below the screed type B



1 = floor covering
2 = weight bearing and thermal diffusion layer (screed)
3 = heating/cooling pipe
4 = protection layer
5 = insulating layer
6 = structural base
8 = double separating layer
9.= adjustment screed

Figure A.3 — Systems with pipes inside the screed type C



1 = floor covering
2 = weight bearing and thermal diffusion layer (screed)
3 = surface element
5 = insulating layer
6 = structural base

Figure A.4 — Heating/Cooling Element Layer (plane section systems) type D

Annex B
(informative)

Comparison overview of used symbols

The symbols used in Table 1 are partly not in accordance with commonly used symbols in other European Standards. This is caused by the taking over of the symbols from the former version of EN 1264-2 and EN 1264-3 in order to avoid confusions. The following Table 2 includes an overview of differing used symbols of the standard series EN 1264 in comparison to commonly used ones.

Table B.1 — Comparison overview of used symbols

Symbol used in EN 1264	Quantity	Commonly used symbols
c_W	Specific heat capacity of water	c_p
K_H	Equivalent heat transmission coefficient represented by the gradient of characteristic curve	U_H
L	Width of heat diffusion devices	l
$Q_{C,f}$	Standard cooling load	$\Phi_{C,f}$
Q_F	Design thermal output of floor heating systems	Φ_F
$Q_{N,f}$	Standard heat load of a floor heated room	$\Phi_{N,f}$
Q_{out}	Additional required thermal output	Φ_{out}
q	Specific thermal output of floor heating systems	Φ
q_u	Downward specific heat loss of floor heating systems	Φ_u
s_h	In Type B systems, the overall thickness of thermal insulation (see EN 1264-3:2009, Figure A.3)	d_h
s_l	In Type B systems, the overall thickness of thermal insulation less heating pipe diameter (see EN 1264-3:2009, Figure A.3)	d_l
s_{ins}	Thickness of thermal insulation	d_{ins}
s_0	Tolerance for repeatability precision	d_0
s_m	Tolerance for reproducibility precision	d_m
s_R	Pipe wall thickness	d_R

Table B.1 (continued)

Symbol used in EN 1264	Quantity	Commonly used symbols
s_u	Thickness of the layer (screed, timber) above the pipe	d_U
s_{WL}	Thickness of heat diffusion device	d_{WL}
T	Pipe spacing	s
α	Heat exchange coefficient	h
$1/\alpha$	Heat exchange resistance	$1/h$
$\vartheta_{C,in}$	Inlet (flow) water temperature of cooling systems	$\theta_{C,in}$
$\vartheta_{C,in,des}$	Design inlet (flow) water temperature of cooling systems	$\theta_{C,in,des}$
$\vartheta_{C,out}$	Outlet (return) water temperature of cooling systems	$\theta_{C,out}$
$\vartheta_{F,m}$	Average surface temperature	$\theta_{F,m}$
$\vartheta_{F,max}$	Maximum floor surface temperature	$\theta_{F,max}$
ϑ_{Gl}	Ambient reference temperature measured with globe thermometer	θ_{Gl}
ϑ_H	Average temperature of the heating medium	θ_H
$\vartheta_{HFM,a}$	Temperature of the surface on top of the heat flow meter plate	$\theta_{HFM,a}$
$\vartheta_{HFM,b}$	Temperature of the surface at the bottom of the heat flow meter plate	$\theta_{HFM,b}$
ϑ_i	Standard indoor room temperature	θ_i
$\vartheta_{F,j}$	Localized floor surface temperature	$\theta_{F,j}$
ϑ_R	Return temperature of heating medium	θ_R
ϑ_V	Flow (supply) temperature of heating medium	Θ_V
$\vartheta_{V,des}$	Design flow water temperature of floor heating systems, determined by room with q_{max}	$\theta_{V,des}$
ϑ_u	Temperature in a room under the floor heated room	θ_u

Table B.1 (continued)

Symbol used in EN 1264	Quantity	Commonly used symbols
$\Delta\vartheta_C$	Temperature difference between room and cooling medium for cooling systems	$\Delta\theta_C$
$\Delta\vartheta_{C,N}$	Standard temperature difference between room and cooling medium for cooling systems	$\Delta\theta_{C,\,N}$
$\vartheta_{Dp,R}$	Regional dew point	$\theta_{Dp,R}$
$\vartheta_{Dp,R0}$	Specified value of regional dew point	$\theta_{Dp,R0}$
$\vartheta_{Dp,des}$	Design dew point	$\theta_{Dp,des}$
$\Delta\vartheta_H$	Temperature difference between heating medium and room	$\Delta\theta_H$
$\Delta\vartheta_{H,des}$	Design temperature difference between heating medium and room of floor heating systems	$\Delta\theta_{H,\,des}$
$\Delta\vartheta_{H,G}$	Limit value of temperature difference between heating medium and room for floor heating systems	$\Delta\theta_{H,G}$
$\Delta\vartheta_{H,j}$	Heating circuit design temperature difference between heating medium and room of floor heating systems determined by q_j, in circuits operated at the same value $\vartheta_{V,des}$	$\Delta\theta_{H,j}$
$\Delta\vartheta_{H,N}$	Standard temperature difference between heating medium and room for heating systems, with the exception of floor heating	$\Delta\theta_{H,N}$
$\Delta\vartheta_{C,N}$	Standard temperature difference between room and cooling medium for cooling systems	$\Delta\theta_{C,N}$
$\Delta\vartheta_N$	Standard temperature difference between heating medium and room for floor heating systems	$\Delta\theta_N$
$\Delta\vartheta_V$	Temperature difference between flow temperature and standard room temperature	$\Delta\theta_V$
$\Delta\vartheta_{V,des}$	Design temperature difference between flow of heating medium and room of floor heating systems, determined by room with q_{max}	$\Delta\theta_{V,\,des}$

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