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Building environment design — Embedded radiant heating and cooling systems —

Part 1: Definitions, symbols, and comfort criteria

AMENDMENT 1

Conception de l'environnement des bâtiments — Systèmes intégrés de chauffage et de refroidissement par rayonnement —

Partie 1: Définitions, symboles et critères de confort

AMENDEMENT 1

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This document was prepared by Technical Committee ISO/TC 205, *Building environment design*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 228, *Heating systems and water based cooling systems in buildings,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 11855 series can be found on the ISO website.

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Building environment design — Embedded radiant heating and cooling systems —

Part 1: Definitions, symbols, and comfort criteria

AMENDMENT 1

Contents

Modify the title of 5.4.3 as follows:

5.4.3 Acoustical comfort in thermo active building systems (TABS)

Foreword

Add the following sentence to the revision paragraph:

The main changes are as follows:

— radiant systems are newly classified into types according to the differences in the calculation method to determine the thermal output of the system;

— Annex C, which summarizes the characteristics of the newly classified radiant system types, has been added for easy reference.

Clause 4

Modify the rows in Table 1 as follows:

S	m	Thickness of the screed (excluding the pipes in the system type I)
s_h	m	In the system type II, thickness of thermal insulation from the outward edge of the insulation to the inward edge of the pipes (see Figure 1)
s_l	m	In the system type II, thickness of thermal insulation from the outward edge of the insulation to the outward edge of the pipes (see Figure 1)

5.3.3, Figure 1

Modify the figure key as follows:

Key

X vertical air temperature difference between head and feet, in K

Y percentage dissatisfied, in %

5.4.3

Modify the title as follows:

5.4.3 Acoustical comfort in thermo active building systems (TABS)

Clause 6

Add a new Clause 6 after Clause 5.

6 Types of radiant system

6.1 General

Radiant systems are classified into types according to the differences in the calculation method to determine the thermal output of the system. The configuration of each system type was explained by the main elements and layers constituting the system.

Radiant system types are composed of a combination of some, or all of the following main elements and layers:

— Ag: air gap

— Ct: capillary tubes

— In: thermal insulation layer

— Pe: pipes or electric cables

— Pt: protection layer

— Sc: structural construction

— Sf: surface layer

— St: structural layer

— Su: surface layer

— Tc: thermal conduction layer

— Td: thermal diffusion layer

— Tr: thermal reflection layer

The thermal diffusion layer also has a function of weight distribution in the floor application. Depending on whether the radiant system is heating or cooling, a heated or a cooled thermal medium is supplied through pipes. The pipes shown in the types of radiant system are electric cables for electrical heating systems.

The thermal output of a radiant system can be obtained from the thermal output calculation methods according to radiant system types described in ISO 11855-2. For radiant systems that do not belong to the types of radiant system, thermal output can be obtained by measurement or detailed calculation methods by finite difference or finite element method.

In the description of each radiant system type, the main characteristics of the system type, the variant radiant systems that belong to this type, thermal medium and installation method, methods for determining the thermal output, application, and previous system types that belong to this type

are included. A clear definition of the radiant system types allows the proper design, dimensioning, installation and control of the system.

Tables summarizing the characteristics of the newly classified radiant system types are given in Annex C. Tables C.1 to C.5 facilitate the understanding of the new types of radiant system and can be used for quick reference and citation.

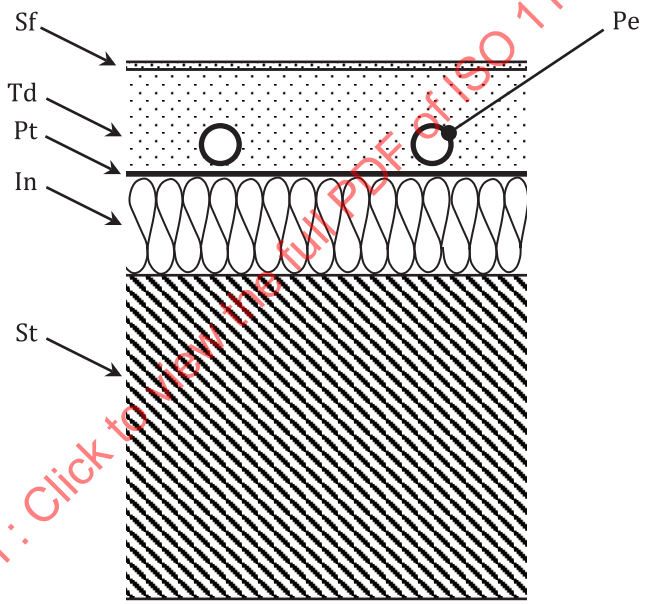
6.2 Radiant system Type I — Pipes directly included in a thermal diffusion layer

The system is characterized by the installation of pipes embedded in the screed. Above the screed different floor coverings can be arranged. The main feature of the construction is that the pipes are completely embedded in a support layer. The system can be constructed with and without an insulation layer. See Figure 2.

For the determination of thermal output, a calculation method is used if the system is in applicable boundary conditions. If the system is not in applicable boundary conditions, the measurement method shall be applied.

The system can be used as a heating and cooling system, installed in floors, walls, and ceilings.

In the old types of radiant system, Types A, C, H, J and I belong to this category.



Key

In	thermal insulation layer
Pe	pipes or electric cables
Pt	protection layer
Sf	surface layer
St	structural layer
Td	thermal diffusion layer

Figure 2 — Radiant system Type I — Pipes directly included in a thermal diffusion layer

6.3 Radiant system Type II — Pipes included in a thermal insulation layer with additional thermal conduction layer

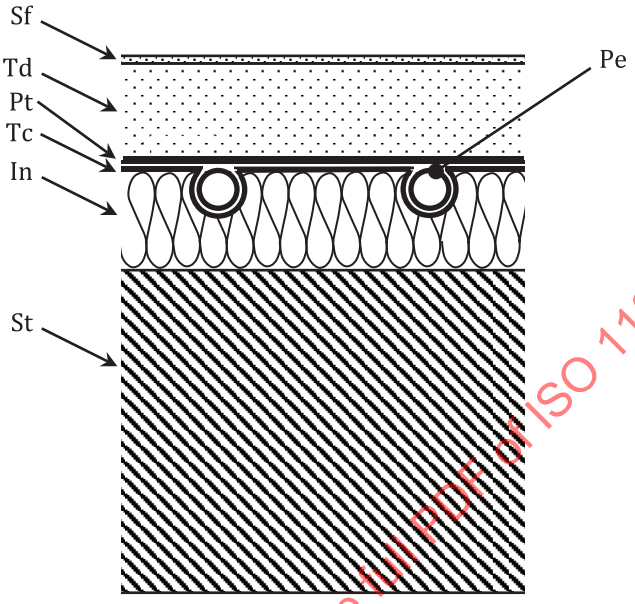
The system is characterized by the installation of pipes enclosed in a thermal conduction layer, e.g. a sheet metal. There must be partial surface contact between the pipe and the thermal conduction layer. The sheet metal may cover the whole surface of the insulation layer or just parts of it. The thermal

conduction layer between the pipes, which can be continuous and interrupted, is important to the thermal performance of the system. See Figure 3.

For the determination of thermal output, a calculation method is used if the system is in applicable boundary conditions. If the system is not in applicable boundary conditions, the measurement method shall be applied.

The system can be used as a heating and cooling system, installed in floors, walls, and ceilings.

In the old types of radiant system, Type B belongs to this category.



Key

In	thermal insulation layer
Pe	pipes or electric cables
Pt	protection layer
Sf	surface layer
St	structural layer
Tc	thermal conduction layer
Td	thermal diffusion layer

Figure 3 — Radiant system Type II — Pipes included in a thermal insulation layer with additional thermal conduction layer

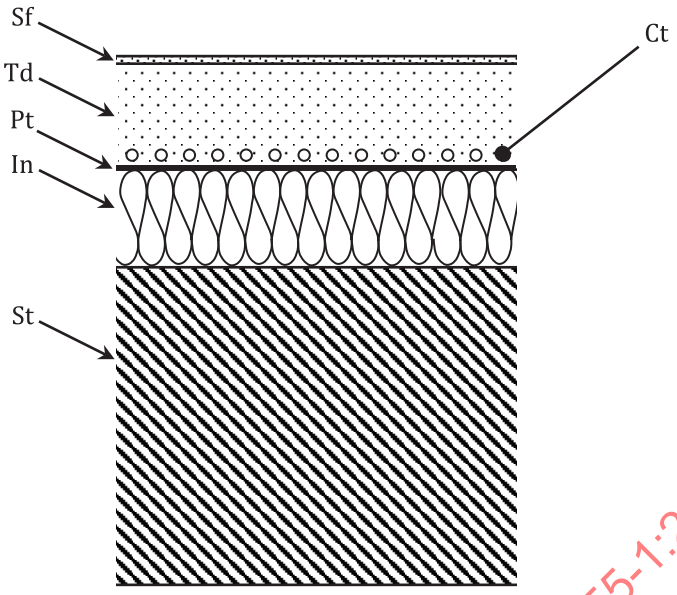
6.4 Radiant system Type III — Capillary tubes directly included in a thermal diffusion layer

The system is characterized by the installation of capillary tubes completely enclosed. Compared to Type I, a very small pipe spacing is realized. In the system, the pipes are integrated in a carrier system or in a plate. The system also covers constructions like Type I but with capillary tubes (capillary tubes located in the middle of the thermal diffusion layer). See Figure 4.

For the determination of thermal output, a calculation method is used if the system is in applicable boundary conditions. If the system is not in applicable boundary conditions, the measurement method shall be applied.

The system can be used as a heating and cooling system, installed in floors, walls, and ceilings.

In the old types of radiant system, Type F belongs to this category.



Key

Ct	capillary tubes
In	thermal insulation layer
Pt	protection layer
Sf	surface layer
St	structural layer
Td	thermal diffusion layer

Figure 4 — Radiant system Type III — Capillary tubes directly included in a thermal diffusion layer

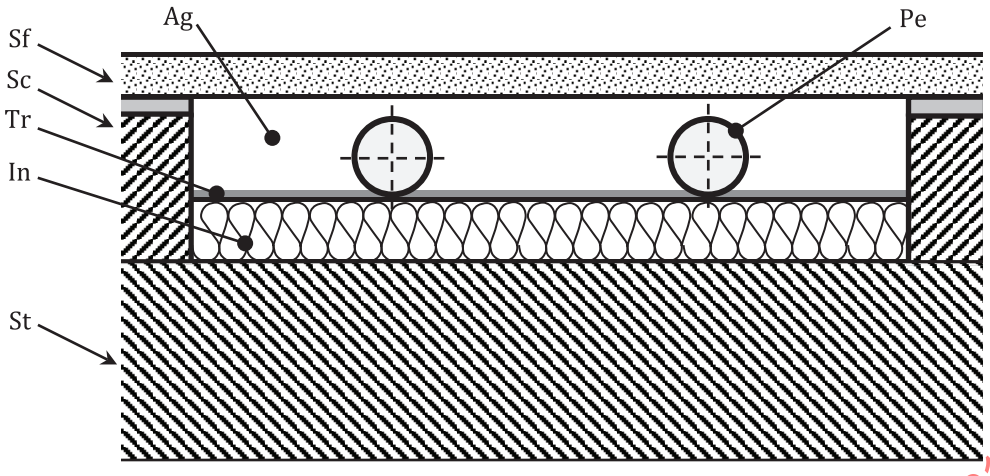
6.5 Radiant system Type IV — Pipes with a thermal reflection layer and an air gap to floor covering

The system is characterized by the installation of pipes on the thermal insulation connected to a thermal reflection layer. The pipes are in a closed space. Between the pipes and the floor covering is an air gap. The pipes are integrated in a carrier system or in a plate. See Figure 5.

For the determination of thermal output, a measurement method shall be applied.

The system can be used as a heating and cooling system. The typical application space for this system is sports halls.

In the old types of radiant system, Type G belongs to this category.



Key

Ag air gap
In thermal insulation layer
Pe pipes or electric cables
Sc structural construction
Sf surface layer (floor covering)
St structural layer
Tr thermal reflection layer

Figure 5 — Radiant system Type IV — Pipes with a thermal reflection layer and an air gap to floor covering

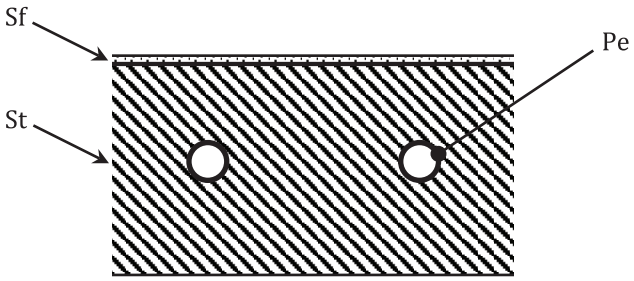
6.6 Radiant system Type V — Pipes included directly in the structural construction (TABS)

The system is characterized by direct integration into the building structure. There is no thermal conduction layer. The pipes are integrated in the structural construction. The heat flow is introduced into the building structure via pipes (hydraulic system). See Figure 6.

For the determination of thermal output, a calculation method shall be applied.

The system can be used as a heating and cooling system, installed in floors, walls, and ceilings. The typical application space of this system is office buildings. If the system is used in external walls, a thermal insulation layer is necessary. If the system is installed in an internal wall / ceiling / floor, the heat flux is transferred in both directions (to the room and to the connected room).

In the old types of radiant system, Type E belongs to this category.



Key

Pe pipes or electric cables
Sf surface layer
St structural layer

Figure 6 — Radiant system Type V — Pipes included directly in the structural construction (TABS)

Annex C

Add the following annex after Annex B, before the Bibliography:

Annex C
(informative)

Types of radiant system

This annex summarizes the contents of Clause 6 in tables. Tables C.1 to C.5 summarize the important characteristics of the new types of radial system by dividing them into system type number, system characteristics, drawing, method for determining the thermal output, application, and old types of radiant system. Tables C.1 to C.5 provide a clear overview of the radiant system types and allows easy comparison. This helps ensure a consistent description in the other parts of the ISO 11855 series, making it easier to understand.

Table C.1 — Radiant system Type I

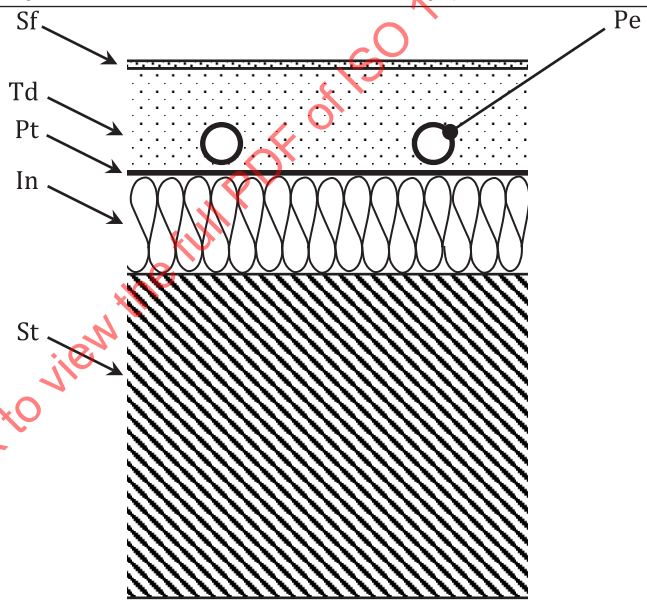
Type	**I**
System characteristics	Pipes directly included in a thermal diffusion layer
Drawing	 **Key** In thermal insulation layer Pe pipes or electric cables Pt protection layer Sf surface layer St structural layer Td thermal diffusion layer
Method for determining the thermal output	Calculation method. If boundary conditions are not fulfilled, measurement method shall be applied.
Application	System can be used as a heating and cooling system, installed in floors, walls, and ceilings.
Old types of radiant system	Types A, C, H, J and I

Table C.2 — Radiant system Type II

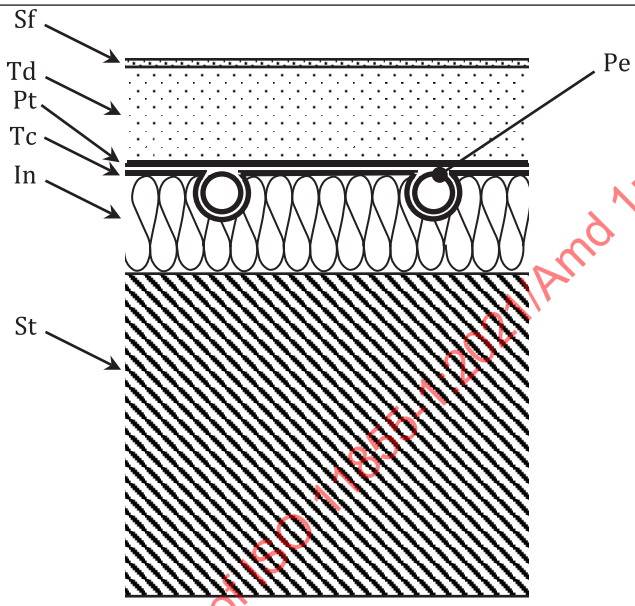
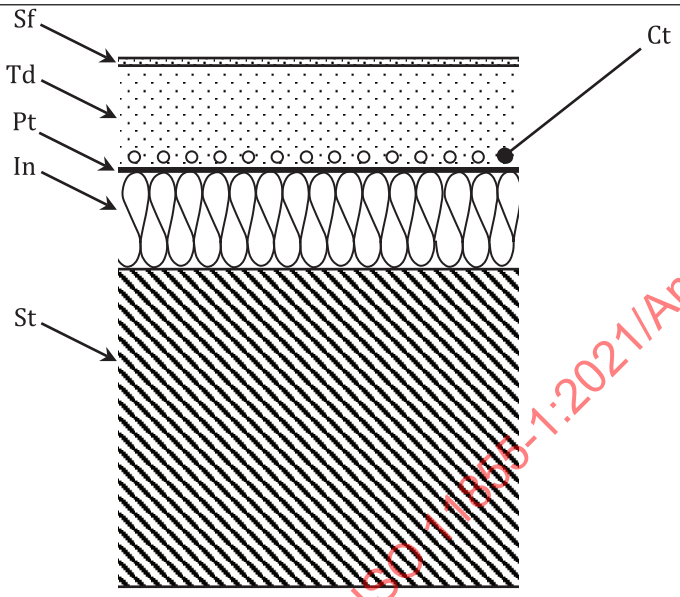
Type	**II**
System characteristics	Pipes included in a thermal insulation layer with additional thermal conduction layer
Drawing	 **Key** In thermal insulation layer Pe pipes or electric cables Pt protection layer Sf surface layer St structural layer Tc thermal conduction layer Td thermal diffusion layer
Method for determining the thermal output	Calculation method. If boundary conditions are not fulfilled, measurement method shall be applied.
Application	System can be used as a heating and cooling system, installed in floors, walls, and ceilings.
Old types of radiant system	Type B

Table C.3 — Radiant system Type III

Type	**III**
System characteristics	Capillary tubes directly included in a thermal diffusion layer
Drawing	 **Key** Ct capillary tubes In thermal insulation layer Pt protection layer Sf surface layer St structural layer Td thermal diffusion layer
Method for determining the thermal output	Calculation method. If boundary conditions are not fulfilled, measurement method shall be applied.
Application	System can be used as a heating and cooling system, installed in floors, walls, and ceilings.
Old types of radiant system	Type F