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Building environment design — Embedded radiant heating and cooling systems —

Part 5:
Installation

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

Partie 5: Installation

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 11855-5 was prepared by Technical Committee ISO/TC 205, *Building environment design*

ISO 11855 consists of the following parts, under the general title *Building environment design — Design, dimensioning, installation and control of embedded radiant heating and cooling systems*:

— Part 1: *Definition, symbols, and comfort criteria*

— Part 2: *Determination of the design and heating and cooling capacity*

— Part 3: *Design and dimensioning*

— Part 4: *Dimensioning and calculation of the dynamic heating and cooling capacity of Thermo Active Building Systems (TABS)*

— Part 5: *Installation*

— Part 6: *Control*

— Part 7: *Input parameters for the energy calculation*

Part 1 specifies the comfort criteria which should be considered in designing embedded radiant heating and cooling systems, since the main objective of the radiant heating and cooling system is to satisfy thermal comfort of the occupants. Part 2 provides steady-state calculation methods for determination of the heating and cooling capacity. Part 3 specifies design and dimensioning methods of radiant heating and cooling systems to ensure the heating and cooling capacity. Part 4 provides a dimensioning and calculation method to design Thermo Active Building Systems (TABS) for energy-saving purposes, since radiant heating and cooling systems can reduce energy consumption and heat source size by using renewable energy. Part 5 addresses the installation process for the system to operate as intended. Part 6 shows a proper control method of the radiant heating and cooling systems to ensure the maximum performance which was intended in the design stage when the system is actually being operated in a building. Part 7 presents a calculation method for input parameters to ISO 52031.

Building environment design — Embedded radiant heating and cooling systems —

Part 5: Installation

1 Scope

This part of ISO 11855 establishes requirements for the installation of embedded radiant heating and cooling systems. It specifies general and uniform requirements for the design and construction of heating and cooling floors, ceiling and wall structures to ensure that the heating/cooling systems are suited to the particular application. The requirements specified by this part of ISO 11855 are applicable only to the components of the heating/cooling systems and the elements which are part of the heating/cooling surface and which are installed due to the heating/cooling systems.

This part of ISO 11855 is applicable to water-based embedded surface heating and cooling systems in residential, commercial and industrial buildings. The methods apply to systems integrated into the wall, floor or ceiling construction without any open-air gaps, but are not applicable to panel systems with open-air gaps which are not integrated into the building structure.

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.

ISO 10508:2006, *Plastics piping systems for hot and cold water installations — Guidance for classification and design*

ISO 11855-1, *Building environment design — Design, dimensioning, installation and control of embedded radiant heating and cooling systems — Part 1: Vocabulary, symbols, and comfort criteria*

ISO 15874 (all parts), *Plastics piping systems for hot and cold water installations — Polypropylene (PP)*

ISO 15875 (all parts), *Plastics piping systems for hot and cold water installations — Crosslinked polyethylene (PE-X)*

ISO 15876 (all parts), *Plastics piping systems for hot and cold water installations — Polybutene (PB)*

ISO 15877 (all parts), *Plastics piping systems for hot and cold water installations — Chlorinated poly(vinyl chloride) (PVC-C)*

ISO 21003-1, *Multilayer piping systems for hot and cold water installations inside buildings — Part 1: General*

ISO 22391 (all parts), *Plastics piping systems for hot and cold water installations — Polyethylene of raised temperature resistance (PE-RT)*

EN 1057, *Copper and copper alloys — Seamless, round copper tubes for water and gas in sanitary and heating applications*

EN 1254 (all parts), *Copper and copper alloys — Plumbing fittings*

DIN 4724, *Kunststoff-Rohrleitungssysteme für Warmwasserheizung und Heizkörperanbindung — Vernetztes Polyethylen mittlerer Dichte (PE-MDX)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11855-1 apply.

Note 1 to entry All terms and definitions in this part of ISO 11855 are consistent with ISO 7345, ISO 9229, ISO 9288, ISO 9346 and ISO 16818.

4 Symbols and abbreviations

For the purposes of this document, the symbols and abbreviations in Table 1 apply.

Table 1 — Symbols and abbreviations

Symbol	Unit	Quantity
D	m	External diameter of the pipe, including sheathing where used
$R_{\lambda,ins}$	m^2K/W	thermal resistance of the insulating layer of the heating/cooling system
s_{ins}	m	Thickness of thermal insulation
ϑ_d	°C	external design temperature
$\vartheta_{V,des,max}$	°C	maximum heating water flow temperatures
λ_{ins}	W/(m·K)	Thermal conductivity of the thermal insulation layer
q	W/m^2	Heat flow density at the surface
q_u	W/m^2	Outward heat flow density
s_h	m	In Type B systems, thickness of thermal insulation from the outward edge of the insulation to the inward edge of the pipes (see Figure 2)
s_1	m	Thickness of the upper part of the slab
W	m	Pipe spacing

5 Installation

5.1 Floor heating and cooling systems

5.1.1 General structural preconditions

The installation of a hot water floor heating and/or cooling system must follow the previous installation of any electrical, sanitary and other pipe facilities. The structure as specified in 5.1.2.1, along with the closure of all building openings, e.g. windows and outer doors, must be completed.

5.1.2 Building layers, building components

5.1.2.1 Supporting base

The supporting base shall be prepared in accordance with relevant standards. Any pipe work or conduits shall be fixed and encased to provide a level base upon which thermal insulation and/or acoustic insulation is added before laying the heating pipes. In this respect, the necessary structural height shall be taken into account. Where service pipes are installed within the insulating layer, they must be protected against temperature change in accordance with national regulations. If the external doors and windows are not present before the installation of the radiant system, it is recommended to close all windows holes, even with provisional systems (in order to avoid too high / low temperatures and to limit the effect of the speed of the air). Walls plaster must be completed.

5.1.2.2 Vapour barrier and other layer

Before install perimeter insulating strip and insulating layers, depending on the type of flooring (e.g wood floor, resin floor, ..) and the system's boundary conditions (installation of floor system on the ground, installation of floor system above unheated environment) must be evaluated the installation of any other layers, for example vapour barrier or similar, in accordance with national regulations and with relevant standards.

5.1.2.3 Insulating layers, perimeter insulating strip

5.1.2.3.1 Thermal resistance of insulating layers

The thermal resistance $R_{\lambda,\text{ins}}$ of the insulating layers of the heating/cooling system shall be calculated as reported in Table 2.

Table 2 — Thermal resistance of insulating layer

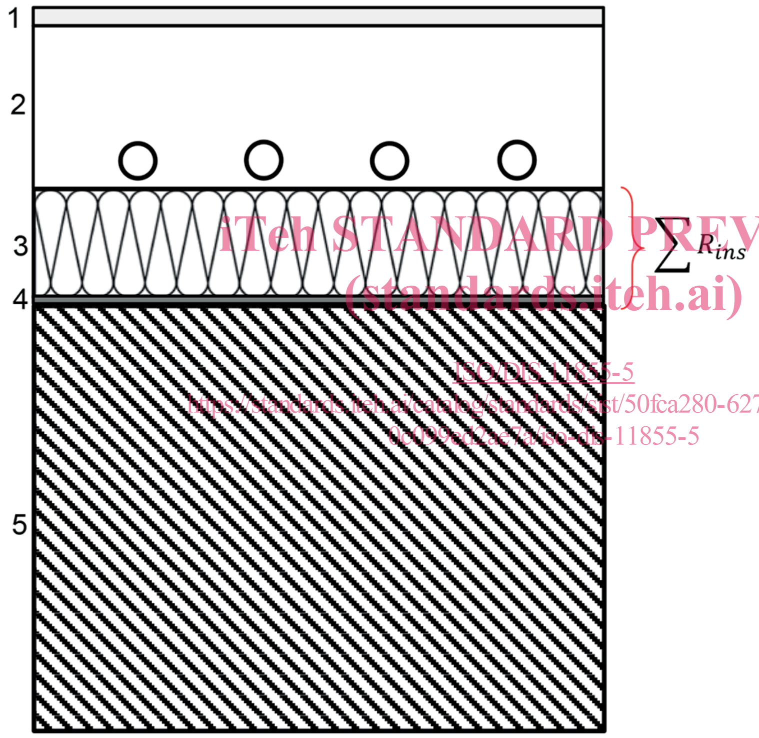
 **Figure 1 — Example of layers for the calculation of $R_{\lambda,\text{ins}}$ - Type A and C** **Key** 1 Floor covering 2 Weight bearing and thermal diffusion layer 3 Thermal insulation 4 Acoustic insulation (if present)) 5 Structural bearing	$R_{\lambda,ins} = \sum \frac{s_{ins}}{\lambda_{ins}}$ (1) $R_{\lambda,\text{ins}}$ is the sum of all the layers with $\lambda_{\text{ins}} < 0.1$ W/(m·K) under the pipeline and over the structural bearing. Layers must be continued and have a certification of λ_{ins} supplied by the manufacturer.

Table 2 *(continued)*

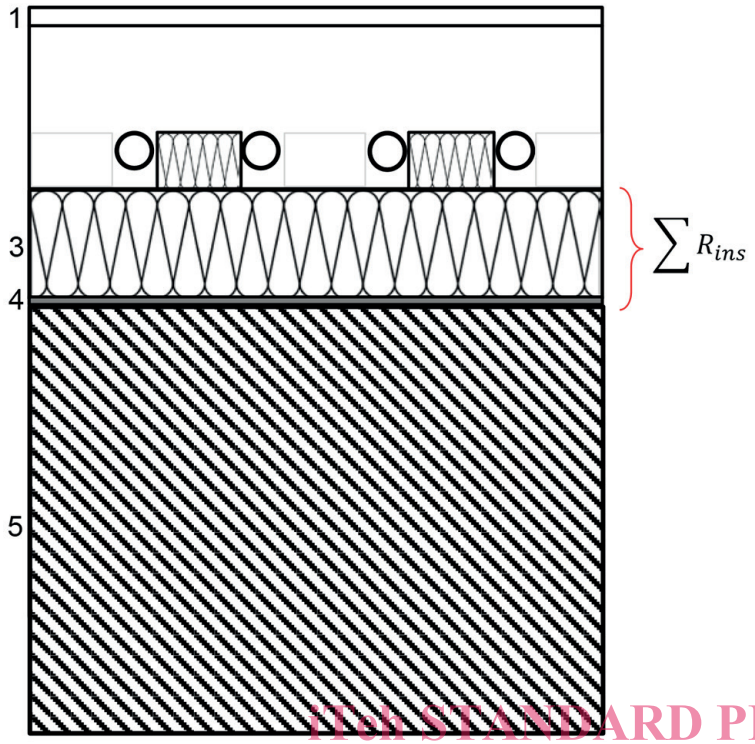
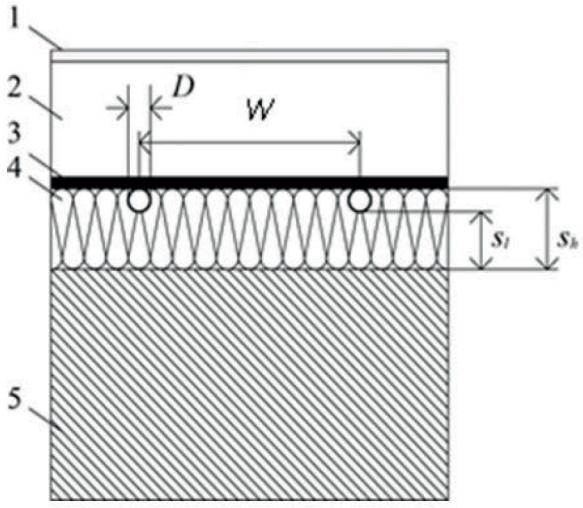
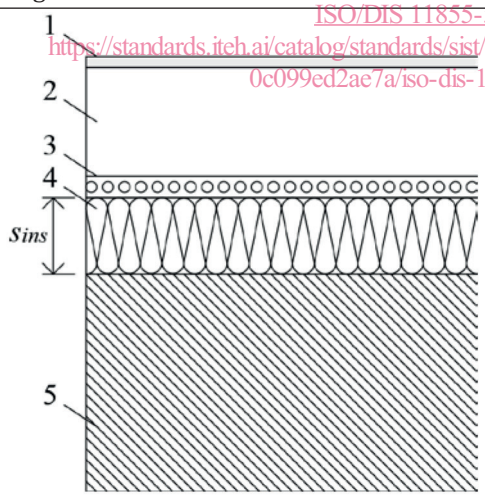
 **Figure 2. Type A and C. System with studs** **Key** 1 Floor covering 2 Weight bearing and thermal diffusion layer 3 Thermal insulation with studs 4 Acoustic insulation (if present) 5 Structural bearing	$R_{\lambda,ins}$ is the sum of all the layers with λ_{ins} < 0.1 W/(m·K) under the pipeline and over the structural bearing. Layers must be continued and have a certification of λ_{ins} supplied by the manufacturer.

Table 2 *(continued)*

 **Figure 3. Type B** **Key** 1 Floor covering 2 Weight bearing and thermal diffusion layer 3 Thermal insulation 4 Acoustic insulation (optional) 5 Lightened screed (if present) 6 Structural bearing	$s_{ins} = \frac{s_h \cdot (W - D) + s_l \cdot D}{W}$ (2) $R_{\lambda,ins}$ is the sum of all the layers with λ_{ins} < 0.1 W/(m·K) under the pipeline and over the structural bearing. Layers must be continued and have a certification of λ_{ins} supplied by the manufacturer.
 **Figure 4. Type D** **Key** 1 Floor covering 2 Weight bearing and thermal diffusion layer 3 Plane section 4 Thermal insulation 5 Structural bearing	$R_{\lambda,ins}$ is the sum of all the layers with λ < 0.1 W/(m·K) under the pipeline. Layers must be continued and have a certification of λ supplied by the manufacturer.

NOTE the position of the insulation affects the inertia of the system. In case of insulation not near piping, inertia and system time constant must be evaluated.