BS EN 14037-1:2016

BSI Standards Publication

Free hanging heating and cooling surfaces for water with a temperature below 120°C

Part 1: Pre-fabricated ceiling mounted radiant panels for space heating — Technical specifications and requirements

bsi.

National foreword

This British Standard is the UK implementation of EN 14037-1:2016. It supersedes BS EN 14037-1:2003 which is withdrawn.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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Free hanging heating and cooling surfaces for water with a temperature below 120°C - Part 1: Pre-fabricated ceiling mounted radiant panels for space heating - Technical specifications and requirements

Panneaux rayonnants de chauffage et de rafraîchissement alimentés avec une eau à une température inférieure à 120 °C - Partie 1 : Panneaux rayonnants de plafond préfabriqués destinés au chauffage des locaux - Spécifications techniques et exigences

An der Decke frei abgehängte Heiz- und Kühlflächen für Wasser mit einer Temperatur unter 120 °C - Teil 1: Vorgefertigte Deckenstrahlplatten zur Raumheizung - Technische Spezifikationen und Anforderungen

This European Standard was approved by CEN on 19 March 2016.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

European foreword

This document (EN 14037-1:2016) 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 supersedes EN 14037-1:2003.

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 March 2017, and conflicting national standards shall be withdrawn at the latest by June 2018.

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 has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports basic work requirements of Regulation (EU) No. 305/2011.

For relationship with Regulation (EU) No. 305/2011, see informative Annex ZA, which is an integral part of this document.

The main changes are:

— the title has been changed,

— the introduction has been changed,

— the scope has been changed,

— new definitions have been added,

— the Annex ZA has been adapted.

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This European Standard results from the recognition, that heated and chilled ceiling radiant panels falling into the field of application hereinafter stated are traded on the basis of their thermal output. For evaluating and comparing different heated and chilled ceiling surfaces it is therefore necessary to refer to a heating stipulated value.

As installations with ceiling mounted radiant panels can also be used in practice for space cooling, it is necessary to have a test method for evaluating the cooling capacity. Installations with different free hanging heating and cooling surfaces need, for the use of space heating a test method for evaluating the heating output. The test method differs from the method for ceiling mounted radiant panels.

The European Standard EN 14037, *Free hanging heating and cooling surfaces for water with a temperature below 120°C*, consists of the following parts:

— *Part 1: Pre-fabricated ceiling mounted radiant panels for space heating - Technical specifications and requirements;*

— *Part 2: Pre-fabricated ceiling mounted radiant panels for space heating - Test method for thermal output;*

— *Part 3: Pre-fabricated ceiling mounted radiant panels for space heating - Rating method and evaluation of radiant thermal output;*

— *Part 4: Pre-fabricated ceiling mounted radiant panels for space heating - Test method for cooling capacity;*

— *Part 5: Open or closed heated ceiling surfaces - Test method for thermal output.*

1 Scope

This European Standard defines technical specifications and requirements of free hanging pre-fabricated ceiling mounted radiant panels with an air gap between construction and the emitter (not embedded) fed with water at temperatures below 120 °C connected with a centralized heating supply source intended to be installed in buildings.

The panels should be installed with an upper insulation.

The European Standard does not apply to independent heating devices.

The European Standard also defines the additional common data that the manufacturer has to provide to the trade in order to ensure the correct application of the products.

This European standard does not cover the performance of hanging accessories.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 13501-1, *Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests*

EN 14037-2:2016, *Free hanging heating and cooling surfaces for water with a temperature below 120°C – Part 2: Pre-fabricated ceiling mounted radiant panels for space heating - Test method for thermal output*

EN 14037-3:2016, *Free hanging heating and cooling surfaces for water with a temperature below 120°C - Part 3: Pre-fabricated ceiling mounted radiant panels for space heating - Rating method and evaluation of radiant thermal output*

EN ISO 2409, *Paints and varnishes - Cross-cut test (ISO 2409)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given below apply.

3.1
heating appliance
device having the purpose of transferring heat in order to provide specific temperature conditions inside buildings

3.2
independent heating appliance
self-contained heating appliance which does not need to be connected to a remote heat source (e. g. a boiler) as it contains its own heat source (e. g. gas fired appliances, electric appliances, heat pump appliances)

3.3
pre-fabricated ceiling mounted radiant panel
pre-fabricated heat-transmitting device in the form of a heating or cooling element with width of 0,3 m up to 1,5 m fitted with connection components or open pipes for in-side-assembling and designed to operate on water flow heating and/or cooling facilities

3.4
model
ceiling mounted radiant panel or heated ceiling surface of defined construction, e.g. width, height, number and diameter of the tubes

3.5
type
group of models with identical modular cross section

3.6
sample
ceiling mounted radiant panel or heated ceiling surface, used for testing

3.7
inlet water temperature
bulk temperature of the water entering the ceiling mounted radiant panel

3.8
outlet water temperature
bulk temperature of the water leaving the ceiling mounted radiant panel

3.9
mean water temperature
arithmetical mean of inlet and outlet water temperature

3.10
water temperature drop
temperature difference between the inlet and outlet water temperature of the pre-fabricated ceiling mounted radiant panel

3.11
mean radiant temperature
temperature in a defined point of the room resulting from the radiation of all surrounding surfaces and of the pre-fabricated ceiling mounted radiant panel respectively heated ceiling surface

3.12
reference room temperature
temperature measured with a globe thermometer

3.13
temperature difference
temperature difference between mean water temperature and reference room temperature

3.14
standard temperature difference of ceiling mounted radiant panels (EN 14037-2)
mean water temperature 75°C and reference room temperature 20°C, determined temperature difference 55 K

3.15
surface temperatures of the inside surfaces of the test room
mean temperatures of the inside surfaces of the test room

3.16
mean surface temperature of the pre-fabricated ceiling mounted radiant panel
mean temperature on the heating or cooling surfaces of the ceiling mounted radiant panel facing the room below

3.17
surface temperature
maximum inlet water temperature

Note 1 to entry: This definition is given for safety requirements only.

3.18
air temperature
indoor air temperature measured by using radiation shields

3.19
active length of the pre-fabricated ceiling mounted radiant panel
length of the usable heating and cooling panels with identical cross section and without connection components and covers, which are bonded together with the water flow components

3.20
connection components
all other components attached to the active length of the ceiling mounted radiant panel which are used for connecting to the distribution system or for venting and draining (see Figure 1)

3.21
indirect heating surface (dry surface)
portion of the heating surface of the panel which is in contact with air only (e.g. radiant sheet between the tubes)

3.22
direct heating surface (wet surface)
portion of the heating surface of the panel which is in contact with the water

3.23
active surface of the pre-fabricated ceiling mounted radiant panel
lower panel surface, the lateral edges are not included

3.24
air pressure
pressure of air measured by a barometer at the testing place

3.25
standard air pressure
pressure of air which is defined as 101,325 kPa (1,01325 bar)

3.26
water flow rate
amount of water flowing through the ceiling mounted radiant panel resp. heating and cooling surface, per unit of time

3.27
total thermal output
thermal output of the active length and of the connection components

3.28
radiant output
thermal output emitted downwards by radiation of the active length

3.29
standard thermal output
thermal output at standard temperature difference, standard air pressure and upper insulation as defined in EN 14037-2

3.30
characteristic equation
equation that gives the thermal output as a function of the temperature difference at constant water flow rate

3.31
construction dimensions
3.31.1
construction length
length of the ceiling mounted radiant panel including the collectors/ headers but excluding the connecting pieces to the heating pipe work

3.31.2
outside diameter of circular tubes
nominal diameter according to standard tube dimensions

3.31.3
dimensions of non-circular tubes
shape and all dimensions necessary to describe exactly the cross section of the tube

3.31.4
distance between tubes
distance between the centre lines of two tubes in parallel

3.31.5
length of tube
length of tubes between collectors / headers

3.31.6
length of radiant sheet
length of the heat transferring sheets

Note 1 to entry: Generally identical with the active length according to 3.19

3.31.7
width of pre-fabricated ceiling mounted radiant panel
width of ceiling mounted radiant panels measured over the outsides of lateral edges

3.31.8
thickness of sheet
thickness of the radiant sheet

3.31.9
height of lateral edges
height of lateral edges of the radiant sheet to hold the upper insulation

3.32
module
1 m of the active length of a pre-fabricated ceiling mounted radiant panel

3.33
modular thermal output
thermal output of one module calculated from the thermal output of the active length of a pre-fabricated ceiling mounted radiant panel, resp. the active surface of a heated ceiling surface

3.34
standard modular thermal output
thermal output of one module at standard conditions including upper insulation as defined in EN 14037-2

3.35
rated thermal output of a pre-fabricated ceiling mounted radiant panel
thermal output evaluated in accordance to EN 14037-3:2016, Clause 5 and referred to the value of the standard modular output of a ceiling mounted radiant panel

3.36
maximum operating pressure
maximum system pressure, to which the panel may be submitted as stated by the manufacturer

3.37
factory test pressure (leak test)
pressure to which the panel is submitted during the manufacturing process

3.38
emissivity
ratio of emissive power of a surface at a given temperature to that of the black body at the same temperature and with the same surroundings

4 Symbols and units

For quantities defined in a different part of this standard reference to this part of the standard is made.

Table 1 — Symbols and units

No.	Quantity	Symbol	Unit
1	Surface area of the non insulated walls	A	m^2
2	Active surface of a heated ceiling surface module	A_a	m^2
3	Active surface of the ceiling mounted radiant panel [b]	A_{rp} [b]	m^2
4	Specific heat capacity	c_p	J/kg K
5	Diameter for connection of inlet/outlet	$D_{I/O}$	mm
6	Outside diameter of tubes	D_O	mm
7	Distance between tubes	d_{tub}	mm
8	Specific enthalpy	h	J/kg
9	Inlet water enthalpy	h_1	J/kg
10	Outlet water enthalpy	h_2	J/kg
11	Height of the void including the height of the test sample	h_v	mm
12	Constant of the characteristic equation of the active length	K_{act}	W/ K ^{nact}
13	Constant of the characteristic equation of the module	K_{actM}	W/(m K ^{nact})
14	Constant of the characteristic equation of the connection components	K_{comp}	W/K ^{ncomp}
15	Constant of the characteristic equation of the module based on the rated thermal output	K_{rto}	W/(m K ^{nact})
16	Constant of the characteristic equation of the construction length	K_{tot}	W/K ^{ntot}
17	Active length of the ceiling mounted radiant panel	L_{act}	mm
18	Height of lateral edges	L_{le}	mm
19	Length of radiant sheet	L_{sh}	mm
20	Construction length	L_{tot}	mm
21	Length of tubes	L_{tub}	mm
22	Dry mass	M	kg
23	Water content	m_v	dm^3
24	Exponent of the characteristic equation of the active length	n_{act}	-
25	Exponent of the characteristic equation of the connection components	n_{comp}	-
26	Exponent of the characteristic equation of the construction length	n_{tot}	-
27	Air pressure	p	kPa
28	Factory test pressure	p_{fact}	kPa
29	Maximum operating pressure	p_{max}	kPa
30	Standard air pressure	p_s [a]	kPa

31	Water flow rate	q_m	kg/s
32	Percentage of radiant output	R	%
33	Thickness of upper insulation	s_i	mm
34	Reproducibility tolerance	s_m	W
35	Repeatability tolerance	s_o	W
36	Thickness of sheet	s_{sh}	mm
37	Thermodynamic temperature	T	K
38	Temperature	t	°C
39	Inlet water temperature	t_1	°C
40	Outlet water temperature	t_2	°C
41	Air temperature	t_a	°C
42	Mean water temperature	t_m	°C
43	Mean radiant temperature	t_{mrad}	°C
44	Reference room temperature	t_{ref}	°C
45	Mean surface temperature of the ceiling mounted radiant panel	t_{rp} [b]	°C
46	Surface temperature of the inside surfaces of the test booth	t_w	°C
47	Width of ceiling mounted radiant panel	W_{rp} [b]	mm
48	Stephan Boltzmann constant ($5{,}67 \times 10^{-8}$)	σ	$W/(m^2 K^4)$
49	Emissivity of the test sample	ε	-
50	Time interval	τ	s
51	Output of the active length	Φ_{act}	W
52	Output of connection components	Φ_{comp}	W
53	Rated thermal output	Φ_D	W/m
54	Modular thermal output	Φ_L	W/m
55	Standard modular thermal output [a]	Φ_{Ls}	W/m
56	Measured output	Φ_{me}	W
57	Standard output of a master panel of the primary set for Inter-laboratory comparisons	$\Phi_{M,s}$	W
58	Standard output of a master panel	$\Phi_{O,s}$	W
59	Radiant output	Φ_{rad}	W
60	Total output	Φ_{tot}	W
61	Temperature difference	ΔT	K
62	Measured temperature difference	ΔT_{me}	K
63	Standard temperature difference of a ceiling mounted radiant panel when heating	ΔT_s	K

a "s" indicates that the value is in standard conditions.

b "rp" indicates that the symbol is referred to the ceiling mounted radiant panel.

5 Requirements

5.1 General manufacturing requirements

The thermal output of a pre-fabricated ceiling mounted radiant panel is mainly transferred downwards to the space by radiation. The thermal output upwards shall be minimized by insulation.

The maximum surface temperature of the lateral edges shall not exceed the minimum surface temperature of the radiant sheet between the last two wet surfaces. For ceiling panels with a construction according to Figure 1 with a tube pitch of X (mm), the distance between the axis of the outside tubes and the edges has to have a minimum distance of 0,5X (mm).

The panel is freely suspended above the useful space and designed to be a permanent part of the building although not a part incorporated in the building structure

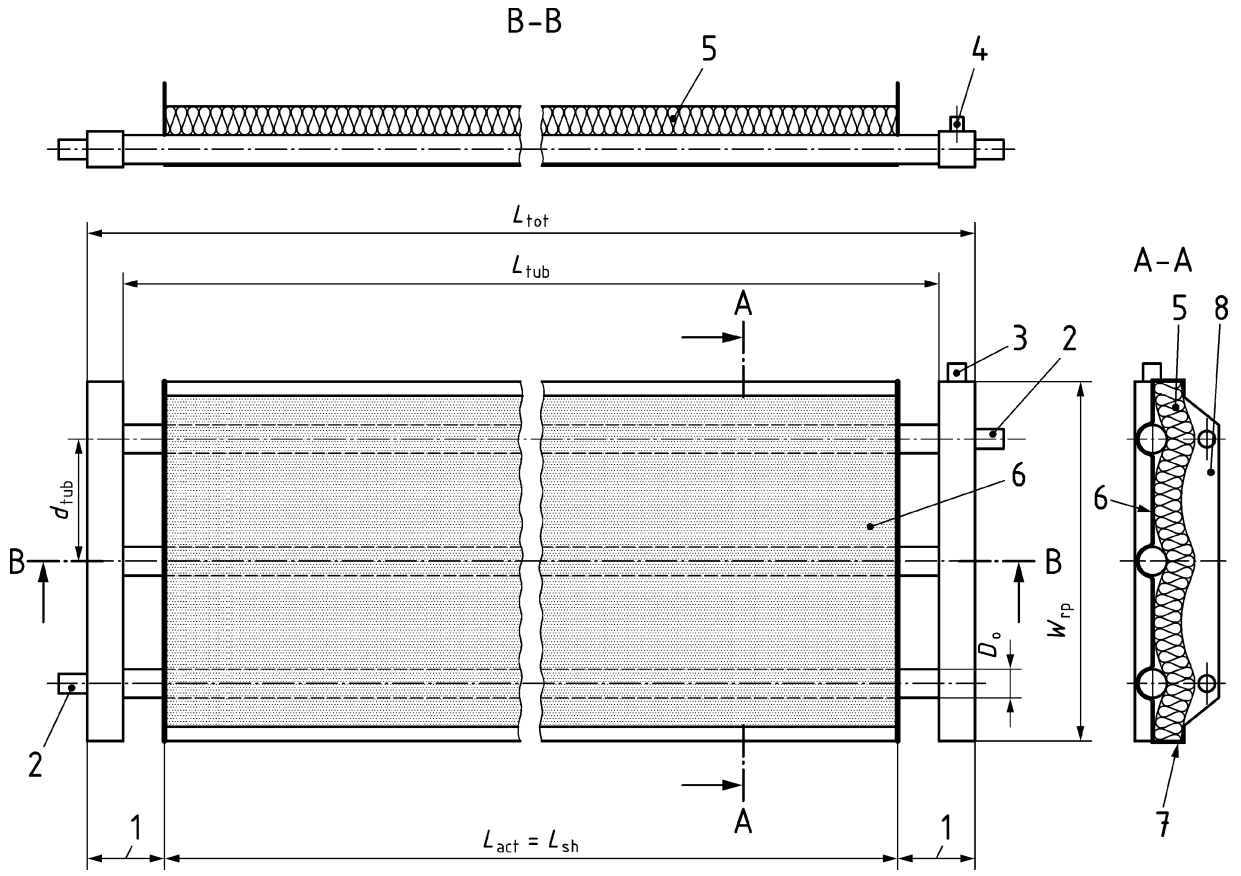
Air flow across the panel is to be prevented.

5.2 Surface protection

If the material in use requires protection, measures for protection against corrosion should be provided.

Paint and varnishes used for protection are considered as part of the free hanging heating surface and are, therefore subject to requirement to dangerous substance.

When and where required the surface protection of the pre-fabricated ceiling mounted radiant panel shall be in accordance with EN ISO 2409 and its performance declared by the manufacturer by referring to class 0 or 1 given in EN ISO 2409.



longitudinal section

Key

1	connection components	5	upper insulation
2	inlet / outlet	6	radiant sheet
3	drain	7	lateral edge
4	vent	8	fixing for suspension
		$L_{act} = L_{sh}$	(only for this example)

Figure 1 — Example for a typical ceiling mounted radiant panel

5.3 Materials

The manufacturers shall declare the materials used for producing the pre-fabricated ceiling mounted radiant panels

5.4 Surface emissivity

The radiating surface of the active heating surface should have an emissivity not lower than 0,8.

5.5 Mechanical resistance

5.5.1 Horizontal curvature of radiant ceiling panels

Horizontal curvature should be no more than 10 mm for a 6 m panel when cold. Shorter ceiling panels should have a maximum curvature in proportion.

NOTE These tolerances apply only to manufactured panels before installation, since site welding can cause distortion.

5.5.2 Vertical deflection of radiant ceiling panels

The maximum vertical deflection between fixing points should be no more than the distance between the fixing points divided by 300 (thus the maximum vertical deflection would be 7 mm for a 2 m distance between fixing points, 10 mm for 3 m between fixing points, etc.)

NOTE These tolerances apply only to manufactured panels before installation, since site welding can cause distortion.

5.6 Resistance to fixings

The fixing points on the pre-fabricated ceiling mounted radiant panel shall be designed to withstand a load of 5 times the allocated mass of the panel, including water, without failure. A loading up to 3 times of the allocated filled mass shall be achieved without any occurrence of permanent deformation. The manufacturer shall submit a statement for the suitability and stability of the fixing points in accordance with pass/fail-criteria.

5.7 Pressure tightness

The headers and their connections to the tubes of the active length (wet surface) of all products leaving the factory shall be tested for leaks with a test pressure equal to at least 1,3 times the maximum operating pressure stated by the manufacturer and declared in accordance with pass/fail-criteria.

The test has to be carried out by using air as pressurizing fluid and be realized by means of a water tank or by leakage indicating mediums and a pneumatic circuit that provides the pressurized air.

5.8 Resistance to pressure

A sample of a panel in accordance with EN 14037-2 shall be tested to ensure that no leakage or permanent deformation will occur at the maximum test pressure, which is a factor of 1,69 times the maximum operating pressure stated by the manufacturer and declared in accordance with pass/fail-criteria.

5.9 Dimensional tolerances

The dimensional deviations of parts of the panel having an influence on the thermal output shall not be greater than the tolerances indicated in the manufacturer's drawings supplied to the laboratory with the testing samples. Under no circumstances shall they be greater than those stated in Table 2. The adherence of the dimensional tolerances of the test samples shall be verified by the test laboratory before the test of the thermal output.

Table 2 — Dimensional tolerances

Dimension	Tolerances
Outside diameter of tubes	±0,50 mm
Distance between tubes	±2 % of the distance
Length of tubes	±3,00 mm
Length of radiant sheet	±3,00 mm
Width of ceiling mounted radiant panel	±6,00 mm
Thickness of sheet	±0,08 mm
Height of lateral edges	±3,00 mm

5.10 Upper Insulation

The upper side of the ceiling mounted heating radiant panels shall be provided with insulation. The thermal resistance of the insulation has a substantial influence on the thermal output upwards.

Ceiling panels used only for cooling can be realized without upper insulation.

For the insulation of the pre-fabricated ceiling mounted radiant panel used by the manufacturer the following information shall be given:

— thermal resistance in m^2 K/W and specific mass in kg/m^3 at 20 °C;

— material for the top cover of the insulation;

— reaction to fire of the materials.

5.11 Water flow resistance

The manufacturer shall provide documentation containing the pressure losses under different mass flow conditions to calculate water flow resistance for differing types of connections and internal circulations.

5.12 Release of dangerous substances

National regulations on dangerous substances may require, verification and declaration on release, and sometimes content, of dangerous substances, when construction products covered by this standard are placed on those markets.

In the absence of European harmonized test methods, verification and declaration on release/content should be done taking into account national provisions in the place of use.

NOTE An informative database covering European and national provisions on dangerous substances is available at the Construction website on EUROPA accessed through: http://ec.europa.eu/enterprise/construction/cpd-ds/

5.13 Reaction to fire

5.13.1 General

Where use of a pre-fabricated ceiling mounted radiant panels is subject to national regulatory requirements on reaction to fire, its reaction to fire performance shall be considered as the one of its components (i.e. material approach) and shall be declared as one of the following classes, according to EN 13501-1:

a) Class A1, without the need for testing (CWT), when meeting the requirements, specified in 5.13.2, or otherwise, or

b) class, defined according to the results of testing of the material(s) used in the unit, according to the standard(s) referred to in EN 13501-1, as specified in 5.13.3.

Conversely, where use of such a unit is not subject to national regulatory requirements on reaction to fire, either class, determined according to a) or b) or "No Performance Determined" (NPD) may be declared.

5.13.2 Pre-fabricated ceiling mounted radiant panels classified as Class A1 without the need for testing

The reaction to fire performance of pre-fabricated ceiling mounted radiant panels shall be declared as Class A1[1] without the need for testing, provided that the pre-fabricated ceiling mounted radiant panels are non-coated metallic material or coated metallic material where the coating does not exceed 1,0 mm of thickness

[1] See Decision of the Commission 96/603/EC of 1996-10-04 (*see OJEU L 267 of 1996-10-19*), as twice amended by 2000/605/EC of 2000-09-26 (*see OJEU L 258 of 2000-10-12*) and by 2003/424/EC of 2003-06-06 (*see OJEU L 144 of 2003-06-12*).

and 1,0 kg/m^2 of mass per unit area[2] and where relevant the insulation material is of class A1 without testing.

5.13.3 Pre-fabricated ceiling mounted radiant panels classified according to the test results

For the purpose of the reaction to fire performance of the pre-fabricated ceiling mounted radiant panels each of its constituent materials including the insulating material if relevant, shall be classified according to EN 13501-1 and only the lowest class of such materials shall be declared. The class of an individual constituent material shall be obtained as the result of the test method(s), relevant to this class, and as specified in the standards referred to in EN 13501-1.

Test specimens used for the test methods, applicable for this classification, shall be prepared according to EN 13501-1 and to the relevant standards referred therein.

Only one model is to be tested to assess the reaction to fire of a type.

5.14 Rated thermal output and characteristic equation

The rated thermal output as defined in 3.35 and the thermal output under different operating conditions have to be determined according to EN 14037-3:2016. The value of the rated thermal output has to be given in W/m as well as *K* and *n* of the characteristic equation $\Phi = K \cdot \Delta t^n$ [in W/m] as defined in EN 14037-2:2016, 8.12.

5.15 Surface temperature

The maximum surface temperature is assumed equal to the system design inlet water temperature[3].

6 Assessment and verification of constancy of performance - AVCP

6.1 General

The compliance of pre-fabricated ceiling mounted radiant panels with the requirements of this standard and with the performances declared by the manufacturer in the Declaration of Performance (DoP) shall be demonstrated by:

- determination of the product-type on the basis of type testing

- factory production control by the manufacturer, including product assessment.

The manufacturer shall always retain the overall control and shall have the necessary means to take responsibility for the conformity of the product with its declared performance(s).

6.2 Type testing

6.2.1 General

All performances related to characteristics included in this standard shall be determined when the manufacturer intends to declare the respective performances unless the standard gives provisions for declaring them without performing tests. (e.g. use of previously existing data, classification without further testing –CWFT- and conventionally accepted performance).

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2 See Decision 2000/147 EC for non-substantial components. (add the reference to the Official Journal)

3 Pre-fabricated ceiling mounted radiant panels are heat emitters without internal heat source. The maximum water temperature is decided by the system designer and controlled by safety devices in the heating system.

Assessment previously performed in accordance with the provisions of this standard, may be taken into account provided that they were made to the same or a more rigorous test method, under the same AVCP system on the same product such that the results are applicable to the product in question.

For the purposes of assessment, the manufacturer's products may be grouped into families, where it is considered that the results for one or more characteristics from any one product within the family are representative for that same characteristics for all products within that same family

In addition, the determination of the product type shall be performed for all characteristics included in the standard for which the manufacturer declares the performance:

— at the beginning of the production of a new or modified pre-fabricated ceiling mounted radiant panels (unless it is a member of the same product range); or

— at the beginning of a new or modified method of production (where this may affect the stated properties); or

— they shall be repeated for the appropriate characteristic(s), whenever a change occurs in the free hanging ceiling mounted radiant panels design, in the raw material, in the supplier of the components (accessories) or in the method of production (subject to the definition of a family), which would affect significantly one or more of the characteristics.

Where components are used whose characteristics have already been determined, by the component manufacturer, on the basis of assessment methods of other product standards, these characteristics need not be re-assessed. The specifications of these components shall be documented.

Products bearing regulatory marking in accordance with appropriate harmonized European specifications may be presumed to have the performances declared in the Declaration of Performance (DoP), although this does not replace the responsibility on the pre-fabricated ceiling mounted radiant panels manufacturer to ensure that the pre-fabricated ceiling mounted radiant panels as a whole are correctly manufactured and their component products (accessories) have the declared performance values.

6.2.2 Test samples, testing and compliance criteria

The number of samples of pre-fabricated ceiling mounted radiant panels to be tested/assessed shall be in accordance with Table 3.

Table 3 — Number of samples to be tested and compliance criteria

Characteristic	Requirement	Assessment method	No. of samples	Compliance criteria
Reaction to fire	5.13	5.13	1 per type	Meet the intended declared class according to 5.13
Release of dangerous substances	5.12	5.12	In accordance with national regulations in use.	According to 5.12
Pressure tightness	5.7	5.7	1 per type.	No leakage as pass/fail according to 5.7
Surface temperature [a)]	5.15	5.15	Not applicable	According to the design of the heating system and never higher than 120 °C[a] according to 5.15.
Resistance to pressure	5.8	5.8	1 per type	No breakage as pass/fail according to 5.8.
Rated thermal output	5.14	5.14	Each model according to EN 14037–2:2016, 8.2	Declared value in W at ΔT = 55 K according to 5.14.
Thermal output in different operating conditions *(characteristic curve)*	5.14	5.14	Each model according to EN 14037–2:2016, 8.2	Declared value for the exponent n and the coefficient k of the characteristic equation according to 5.14.
Durability against corrosion (surface protection)	5.2	5.2	1 per type	5.2
Resistance to fixings	5.6	5.6	1 per model	5.6
[a)] Pre-fabricated ceiling mounted radiant panels are heat emitters without internal heat source. The maximum water temperature is decided by the system designer and controlled by safety devices in the heating system.				

6.2.3 Test reports

The results of the determination of the product type shall be documented in test reports. All test reports shall be retained by the manufacturer for at least 10 years after the last date of production of the pre-fabricated ceiling mounted radiant panels to which they relate.

6.2.4 Shared other party results

A manufacturer may use the results of the product type determination obtained by someone else (e.g. by another manufacturer, as a common service to manufacturers, or by a product developer), to justify his own declaration of performance regarding a product that is manufactured according to the same design (e.g. dimensions) and with raw materials, constituents and manufacturing methods of the same kind, provided that:

– the results are known to be valid for products with the same essential characteristics relevant for the product performance;

- in addition to any information essential for confirming that the product has such same performances related to specific essential characteristics, the other party who has carried out the determination of the product type concerned or has had it carried out, has expressly accepted[4] to transmit to the manufacturer the results and the test report to be used for the latter's product type determination, as well as information regarding production facilities and the production control process that can be taken into account for FPC;

- the manufacturer using other party results accepts to remain responsible for the product having the declared performances and he also:

  - ensures that the product has the same characteristics relevant for performance as the one that has been subjected to the determination of the product type, and that there are no significant differences with regard to production facilities and the production control process compared to that used for the product that was subjected to the determination of the product type; and

  - keeps available a copy of the determination of the product type report that also contains the information needed for verifying that the product is manufactured according to the same design and with raw materials, constituents and manufacturing methods of the same kind.

6.3 Factory production control (FPC)

6.3.1 General

The manufacturer shall establish, document and maintain an FPC system to ensure that the products placed on the market comply with the declared performance of the essential characteristics.

The FPC system shall consist of procedures, regular inspections and tests and/or assessments and the use of the results to control raw and other incoming materials or components, equipment, the production process and the product.

All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures.

This factory production control system documentation shall ensure a common understanding of the evaluation of the constancy of performance and enable the achievement of the required product performances and the effective operation of the production control system to be checked. Factory production control therefore brings together operational techniques and all measures allowing maintenance and control of the compliance of the product with the declared performances of the essential characteristics.

In case the manufacturer has used shared product type results, the FPC shall also include the appropriate documentation as foreseen in 6.2.4.

6.3.2 Requirements

6.3.2.1 General

The manufacturer is responsible for organizing the effective implementation of the FPC system in line with the content of this product standard. Tasks and responsibilities in the production control organization shall be documented and this documentation shall be kept up-to-date.

The responsibility, authority and the relationship between personnel that manages, performs or verifies work affecting product constancy, shall be defined. This applies in particular to personnel that need to initiate actions preventing product non-constancies from occurring, actions in case of non-constancies and to identify and register product constancy problems.

[4]The formulation of such an agreement can be done by licence, contract, or any other type of written consent.

Personnel performing work affecting the constancy of performance of the product shall be competent on the basis of appropriate education, training, skills and experience for which records shall be maintained.

In each factory the manufacturer may delegate the action to a person having the necessary authority to:

— identify procedures to demonstrate constancy of performance of the product at appropriate stages;

— identify and record any instance of non-constancy;

— identify procedures to correct instances of non-constancy.

The manufacturer shall draw up and keep up-to-date documents defining the factory production control. The manufacturer's documentation and procedures should be appropriate to the product and manufacturing process. The FPC system should achieve an appropriate level of confidence in the constancy of performance of the product. This involves:

a) the preparation of documented procedures and instructions relating to factory production control operations, in accordance with the requirements of the technical specification to which reference is made;

b) the effective implementation of these procedures and instructions;

c) the recording of these operations and their results;

d) the use of these results to correct any deviations, repair the effects of such deviations, treat any resulting instances of non-conformity and, if necessary, revise the FPC to rectify the cause of non-constancy of performance.

Where subcontracting takes place, the manufacturer shall retain the overall control of the product and ensure that he receives all the information that is necessary to fulfil his responsibilities according to this European standard.

If the manufacturer has part of the product designed, manufactured, assembled, packed, processed and/or labelled by subcontracting, the FPC of the subcontractor may be taken into account, where appropriate for the product in question.

The manufacturer who subcontracts all of his activities may in no circumstances pass the above responsibilities on to a subcontractor.

NOTE Manufacturers having an FPC system, which complies with EN ISO 9001 standard and which addresses the provisions of the present European standard are considered as satisfying the FPC requirements of the Regulation (EU) No 305/2011.

6.3.2.2 Equipment

6.3.2.2.1 Testing

All weighing, measuring and testing equipment shall be calibrated and regularly inspected according to documented procedures, frequencies and criteria.

6.3.2.2.2 Manufacturing

All equipment used in the manufacturing process shall be regularly inspected and maintained to ensure use, wear or failure does not cause inconsistency in the manufacturing process. Inspections and maintenance shall be carried out and recorded in accordance with the manufacturer’s written procedures and the records retained for the period defined in the manufacturer's FPC procedures.

6.3.2.3 Raw materials and components

The specifications of all incoming raw materials and components shall be documented, as shall the inspection scheme for ensuring their compliance. In case supplied kit components are used, the constancy of per-

formance system of the component shall be that given in the appropriate harmonized technical specification for that component.

6.3.2.4 Controls during manufacturing process

The manufacturer shall plan and carry out production under controlled conditions and shall ensure that:

— The dimensional tolerances shall be maintained according to 5.9,

— The rated thermal output is not lower than 4 % of the declared output data,

— Pressure tightness shall be tested as foreseen in 5.7,

— There is no corrosion evidence on the product.

6.3.2.5 Product testing and evaluation

The manufacturer shall establish procedures to ensure that the stated values of the characteristics he declares are maintained. The characteristics, and the means of control, are:

Table 4 — Verification method and frequency

Characteristic	Requirement	Verification method	No. of samples	Frequency	Compliance criteria
Reaction to fire	5.13	Visual inspection of incoming materials and related documents.	1 per delivery of materials	For every new incoming material when received.	Verify that materials are the same of those used in the initial type testing.
Release of dangerous substances	5.12	Visual inspection of incoming materials and related documents.	1 per delivery of materials	For every new incoming material when received.	Verify that materials are the same of those used in the initial type testing.
Pressure tightness	5.7	5.7	All panels	All panels	No leakage, according to 5.7
Surface temperature	5.15	-	-	-	-
Resistance to pressure	5.8	5.8	1 per type	Every time there is a change in welding process or in materials in contact with water	No breakage or permanent deformation, according to 5.8.
Rated thermal output	5.14	Verification of dimensions and manufacturer's material specifications	1 model	For every new incoming material when received, when changing the production process and when starting to manufacture a different model	Compliance with dimensional tolerances according to 5.9 and material specifications
Thermal output in different operating conditions *(characteristic curve)*					
Durability against corrosion (surface protection)	5.2	5.2	1 per type	At least once per month	5.2
Resistance to fixings	5.6	5.6	1 per model	When changing the production process or material specifications and/or dimensions.	5.6

6.3.2.6 Non-complying products

The manufacturer shall have written procedures which specify how non-complying products shall be dealt with. Any such events shall be recorded as they occur and these records shall be kept for the period defined in the manufacturer’s written procedures.

Where the product fails to satisfy the acceptance criteria, the provisions for non-complying products shall apply, the necessary corrective action(s) shall immediately be taken and the products or batches not complying shall be isolated and properly identified.

Once the fault has been corrected, the test or verification in question shall be repeated.

The results of controls and tests shall be properly recorded. The product description, date of manufacture, test method adopted, test results and acceptance criteria shall be entered in the records under the signature of the person responsible for the control/test.

With regard to any control result not meeting the requirements of this European standard, the corrective measures taken to rectify the situation (e.g. a further test carried out, modification of manufacturing process, throwing away or putting right of product) shall be indicated in the records.

6.3.2.7 Corrective action

The manufacturer shall have documented procedures that instigate action to eliminate the cause of non-conformities in order to prevent recurrence.

6.3.2.8 Handling, storage and packaging

The manufacturer shall have procedures providing methods of product handling and shall provide suitable storage areas preventing damage or deterioration.

6.3.3 Product specific requirements

The FPC system shall address this European Standard and ensure that the products placed on the market comply with the declaration of performance.

The FPC system shall include a product specific FPC, which identifies procedures to demonstrate compliance of the product at appropriate stages, i.e.:

a) the controls and tests to be carried out prior to and/or during manufacture according to a frequency laid down in the FPC test plan,

and/or

b) the verifications and tests to be carried out on finished products according to a frequency laid down in the FPC test plan

If the manufacturer uses only finished products, the operations under b) shall lead to an equivalent level of compliance of the product as if FPC had been carried out during the production.

If the manufacturer carries out parts of the production himself, the operations under b) may be reduced and partly replaced by operations under a). Generally, the more parts of the production that are carried out by the manufacturer, the more operations under b) may be replaced by operations under a).

In any case the operation shall lead to an equivalent level of compliance of the product as if FPC had been carried out during the production.

NOTE Depending on the specific case, it can be necessary to carry out the operations referred to under a) and b), only the operations under a) or only those under b).

The operations under a) refer to the intermediate states of the product as on manufacturing machines and their adjustment, and measuring equipment etc. These controls and tests and their frequency shall be chosen based on product type and composition, the manufacturing process and its complexity, the sensitivity of product features to variations in manufacturing parameters etc.

The manufacturer shall establish and maintain records that provide evidence that the production has been sampled and tested. These records shall show clearly whether the production has satisfied the defined acceptance criteria and shall be available for at least three years.

6.3.4 Initial inspection of factory and of FPC

This clause is applicable only for pre-fabricated ceiling mounted radiant panels under AVCP system 1.

Initial inspection of factory and of FPC shall be carried out when the production process has been finalized and in operation. The factory and FPC documentation shall be assessed to verify that the requirements of 6.3.2 and 6.3.3 are fulfilled.

During the inspection it shall be verified:

a) that all resources necessary for the achievement of the product characteristics included in this European standard are in place and correctly implemented,

and

b) that the FPC-procedures in accordance with the FPC documentation are followed in practice,

and

c) that the product complies with the product type samples, for which compliance of the product performance to the DoP has been verified.

All locations where final assembly or at least final testing of the relevant product is performed, shall be assessed to verify that the above conditions a) to c) are in place and implemented. If the FPC system covers more than one product, production line or production process, and it is verified that the general requirements are fulfilled when assessing one product, production line or production process, then the assessment of the general requirements does not need to be repeated when assessing the FPC for another product, production line or production process.

All assessments and their results shall be documented in the initial inspection report.

6.3.5 Continuous surveillance of FPC

This clause is applicable only for pre-fabricated ceiling mounted radiant panels under AVCP system 1.

Surveillance of the FPC shall be undertaken once per year. The surveillance of the FPC shall include a review of the FPC test plan(s) and production processes(s) for each product to determine if any changes have been made since the last assessment or surveillance. The significance of any changes shall be assessed.

Checks shall be made to ensure that the test plans are still correctly implemented and that the production equipment is still correctly maintained and calibrated at appropriate time intervals.

The records of tests and measurement made during the production process and to finished products shall be reviewed to ensure that the values obtained still correspond with those values for the samples submitted to the determination of the product type and that the correct actions have been taken for non-compliant products.

6.3.6 Procedure for modifications

If modifications are made to the product, production process or FPC system that could affect any of the product characteristics declared according to this standard, then all the characteristics for which the manufacturer declares performance, which may be affected by the modification, shall be subject to the determination of the product type, as described in 6.2.1.

Where relevant, a re-assessment of the factory and of the FPC system shall be performed for those aspects, which may be affected by the modification.

All assessments and their results shall be documented in a report.

6.3.7 One-off products, pre-production products (e.g. prototypes) and products produced in very low quantity

The pre-fabricated ceiling mounted radiant panels produced as a one-off, prototypes assessed before full production is established, and products produced in very low quantities[5] shall be assessed as follows.

For type assessment, the provisions of 6.2.1, 3rd paragraph apply, together with the following additional provisions:

- in case of prototypes, the test samples shall be representative of the intended future production and shall be selected by the manufacturer;

- on request of the manufacturer, the results of the assessment of prototype samples may be included in a certificate or in test reports issued by the involved third party.

The FPC system of one-off products and products produced in very low quantities shall ensure that raw materials and/or components are sufficient for production of the product. The provisions on raw materials and/or components shall apply only where appropriate. The manufacturer shall maintain records allowing traceability of the product.

For prototypes, where the intention is to move to series production, the initial inspection of the factory and FPC shall be carried out before the production is already running and/or before the FPC is already in practice. The following shall be assessed:

— the FPC-documentation; and

— the factory.

In the initial assessment of the factory and FPC it shall be verified:

a) that all resources necessary for the achievement of the product characteristics included in this European standard will be available, and

b) that the FPC-procedures in accordance with the FPC-documentation will be implemented and followed in practice, and

c) that procedures are in place to demonstrate that the factory production processes can produce a product complying with the requirements of this European standard and that the product will be the same as the samples used for the determination of the product type, for which compliance with this European standard has been verified.

Once series production is fully established, the provisions of 6.3 shall apply

[5] Produced for a single project or a production of less than 1 000 m^2 per year.

7 Technical documentation

7.1 General

This clause specifies the minimum data that the manufacturer or authorized representatives shall give in his technical documentation referred to the product for the design and installation of the relevant heating appliance.

Each of the following items shall be identified:

7.2 Designation of the pre-fabricated ceiling mounted radiant panels

Each model will be defined by the same designation as used during the test programme. All data shall refer to this designation.

7.3 Maximum operating pressure

The manufacturer shall state the maximum operating pressure to which the heating appliance may be subjected.

7.4 Maximum operating temperature

The manufacturer shall state the maximum water temperature at which the heating appliance may be operated.

7.5 Thermal output respectively cooling capacity

The manufacturer shall state the standard modular thermal output respectively standard modular cooling capacity, the output of connection components under standard conditions and the rated thermal output, including the exponents of the characteristic equations.

7.6 Dimensions and technical data

The following nominal dimensions and technical data shall be given for each model or type:

— width;

— height;

— length;

— number and type of tubes;

— wall thickness of tubes and radiant sheets;

— outside diameter of tubes;

— size, type and position of connections;

— dry mass;

— water content;

— material specifications;

— statement of strength pressure test;

— minimum number of fixing points and statement of suitability and stability of the fixing points;

— maximum distance between the axes of the fixing points;

— specification of surface coating including the emissivity;

— method of bonding the wet to the dry surface;

— number of bonding points per meter and per tube between the wet and the dry surface;

— specification of upper insulation and method of posing on the panels;

— resistance losses.

7.7 Reference data

All technical documentation and any other literature relevant to the heating appliance shall contain the identification code and the date of issue.

7.8 Installation manual

The installation manual shall include at minimum the following data:

- Safety instructions;
- Storing and handling instructions;
- Assembling instructions;
- Hanging instructions.

Annex ZA
(informative)

Relationship of this European Standard with Regulation (EU) No. 305/2011

(When applying this standard as a harmonized standard under Regulation (EU) No. 305/2011, manufacturers and Member States are obliged by this regulation to use this Annex)

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under standardization request M/129 "Space heating appliances" given to CEN and CENELEC by the European Commission (EC) and the Free Trade Association (EFTA).

When this European Standard is cited in the Official Journal of the European Union (OJEU), under Regulation (EU) No 305/2011, it shall be possible to use it as a basis for the establishment of the Declaration of Performance (DoP) and the CE marking, from the date of the beginning of the co-existence period as specified in the OJEU.

Regulation (EU) No 305/2011, as amended, contains provisions for the DoP and the CE marking.

Table ZA.1 — Relevant clauses for pre-fabricated ceiling mounted radiant panels and intended use

Product: Free hanging ceiling mounted radiant panels for water with a temperature below 120 °C **Intended use**: in buildings			
Essential characteristics	**Clauses of this European Standard related to essential characteristics**	**Classes and/or threshold levels**	**Notes**
Reaction to fire	5.13	A1 to F	A1 without testing or tested in accordance with 5.14 and the class declared
Release of dangerous substances	5.12	-	Tested and declared in accordance with 5.13.
Pressure tightness	5.7	-	Tested and declared in accordance with 5.7 as pass/fail.
Surface temperature	5.15	-	The maximum surface temperature is assumed equal to the system design inlet water temperature.
Resistance to pressure	5.8	-	Tested and declared in accordance with 5.8 as pass/fail.
Rated thermal output	5.14	-	Evaluated in accordance to EN 14037-3 and declared as rated thermal output in W/m and the characteristic equation $\Phi = K \cdot \Delta t^n$ [in W/m], including parameters K and n.
Thermal output in different operating conditions (characteristic curve)			
Durability Surface protection	5.2	-	Tested in accordance with EN ISO 2409 and its performance declared by the manufacturer by referring to one of the classes given in EN ISO 2409.

ZA.2 System of Assessment and Verification of Constancy of Performance (AVCP)

The AVCP system(s) of pre-fabricated ceiling mounted radiant panels indicated in Table ZA.1 can be found in the EC legal acts adopted by the EC: Decision 1999/471/EC of 1999 (published under L184 of 17.07.99) amended by the Decision 2001/596/EC of 8 January (published under L209 of 02.08.01) Micro-enterprises are allowed to treat products under AVCP system 3 covered by this standard in accordance with AVCP system 4, applying this simplified procedure with its conditions, as foreseen in Article 37 of Regulation (EU) No.305/2011

ZA.3 Assignment of AVCP tasks

The AVCP system(s) of pre-fabricated ceiling mounted radiant panels as provided in Table ZA.1 is defined in Tables ZA.3.1 to ZA.3.3 resulting from application of the clauses of this or other European Standards indicated therein. The content of the tasks assigned to the notified body shall be limited to those essential characteristics, if any, as provided for in Annex III of the relevant standardization request and to those that the manufacturer intends to declare.

Taking into account the AVCP systems defined for the products and the intended uses the following tasks are to be undertaken by the manufacturer and the notified body respectively for the assessment and verification of the constancy of performance of the product.

Table ZA.3.1 — Assignment of AVCP tasks for pre-fabricated ceiling mounted radiant panels under systems 1 and 3

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use which are declared	6.3
	Further testing of samples taken at the manufacturing plant by the manufacturer in accordance with the prescribed test plan	Reaction to fire	6.3
Tasks for a notified laboratory	The notified laboratory shall assess the performance on the basis of testing (based on sampling carried out by the manufacturer), calculation, tabulated values or descriptive documentation of the construction product	All essential characteristics of Table ZA.1 relevant for the intended use which are declared except reaction to fire	6.2
Tasks for the notified product certification body	An assessment of the performance of the construction product carried out on the basis of testing (including sampling), calculation, tabulated values or descriptive documentation of the product	Reaction to fire	6.2
	Initial inspection of manufacturing plant and of FPC	Parameters related to essential characteristics of Table ZA.1, relevant for the intended use which are declared, namely reaction to fire. Documentation of the FPC.	6.3

	Continuing surveillance, assessment and evaluation of FPC	Parameters related to essential characteristics of Table ZA.1, relevant for the intended use which are declared, namely reaction to fire. Documentation of FPC	6.3

Table ZA.3.2 — Assignment of AVCP tasks for pre-fabricated ceiling mounted radiant panels under system 3

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use which are declared	6.3
Tasks for a notified laboratory	The notified laboratory shall assess the performance on the basis of testing (based on sampling carried out by the manufacturer), calculation, tabulated values or descriptive documentation of the construction product	All essential characteristics of Table ZA.1 relevant for the intended use which are declared	6.2

Table ZA.3.3 — Assignment of AVCP tasks for pre-fabricated ceiling mounted radiant panels under system 4 and 3

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	An assessment of the performance of the construction product on the basis of testing, calculation, tabulated values or descriptive documentation of that product	Reaction to fire	6.2
	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use which are declared	6.3
Tasks for a notified testing laboratory	The notified laboratory shall assess the performance on the basis of testing (based on sampling carried out by the manufacturer), calculation, tabulated values or descriptive documentation of the construction product	All essential characteristics of Table ZA.1 relevant for the intended use which are declared except reaction to fire	6.2

Bibliography

[1] Regulation (EU) No. 305/2011

[2] Decision 2001/596/EC

[3] EN 14037-4:2016, *Free hanging heating and cooling surfaces for water with a temperature below 120°C - Part 4: Pre-fabricated ceiling mounted radiant panels - Test method for cooling capacity*

[4] EN 14037-5:2016, *Free hanging heating and cooling surfaces for water with a temperature below 120°C - Part 5: Open or closed heated ceiling surfaces - Test method for thermal output*

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