SLOVENSKI STANDARD
SIST EN 13166:2002

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Toplotnoizolacijski proizvodi za stavbe - Proizvodi iz fenolne pene (PF) - Specifikacija

Thermal insulation products for buildings - Factory made products of phenolic foam (PF) - Specification

Wärmedämmstoffe für Gebäude - Werkmäßig hergestellte Produkte aus Phenolharzschaum (PF) - Spezifikation

Produits isolants thermiques pour le bâtiment - Produits manufacturés en mousse phénolique (PF) - Spécification

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91.100.60	Materiali za toplotno in zvoļ no izolacijo	Thermal and sound insulating materials

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English version

Thermal insulation products for buildings - Factory made products of phenolic foam (PF) - Specification

Produits isolants thermiques pour le bâtiment - Produits manufacturés en mousse phénolique (PF) - Spécification

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This European Standard was approved by CEN on 16 April 2001.

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 Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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Contents

Page

Tables

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 88 "Thermal insulation materials and products", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2001, and conflicting national standards shall be withdrawn at the latest by March 2003.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this standard.

This European Standard contains five annexes:

Annex A (normative) Determination of the declared values of thermal resistance and thermal conductivity;

Annex B (normative) Factory production control;

Annex C (normative) Determination of the aged value of thermal resistance and thermal conductivity;

Annex D (informative) Additional properties;

Annex ZA (informative) Clauses of this European Standard addressing the provisions of the EU Construction Products Directive.

This European Standard is one of a series of standards for insulation products used in buildings, but this standard may be used in other areas where appropriate.

In pursuance of Resolution BT20/1993 revised, CEN/TC 88 have proposed defining the standards listed below as a package of European Standards, setting (21 months after availability) as the date of withdrawal (dow) of national standards which conflict with the European Standards of this package.

The package of standards comprises the following group of interrelated standards for the specifications of factory made thermal insulation products, all of which come within the scope of CEN/TC 88:

EN 13162, *Thermal insulation products for buildings – Factory made mineral wool (MW) products – Specification.*

EN 13163, *Thermal insulation products for buildings – Factory made products of expanded polystyrene (EPS) – Specification.*

EN 13164, *Thermal insulation products for buildings – Factory made products of extruded polystyrene foam (XPS) – Specification.*

EN 13165, *Thermal insulation products for buildings – Factory made rigid polyurethane foam (PUR) products – Specification.*

EN 13166, *Thermal insulation products for buildings – Factory made products of phenolic foam (PF) – Specification.*

EN 13167, *Thermal insulation products for buildings – Factory made cellular glass (CG) products – Specification.*

EN 13168, *Thermal insulation products for buildings – Factory made wood wool (WW) products – Specification.*

EN 13169, *Thermal insulation products for buildings – Factory made products of expanded perlite (EPB) – Specification.*

EN 13170, *Thermal insulation products for buildings – Factory made products of expanded cork (ICB) – Specification.*

EN 13171, *Thermal insulation products for buildings – Factory made wood fibre (WF) products – Specification.*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies the requirements for factory made products of phenolic foam, with or without facings, which are used for the thermal insulation of buildings. The products are manufactured in the form of boards and laminates.

This standard describes product characteristics and includes procedures for testing, evaluation of conformity, marking and labelling.

Products covered by this standard are also used in prefabricated thermal insulation systems and composite panels; the performance of systems incorporating these products is not covered.

This standard does not specify the required level of a given property to be achieved by a product to demonstrate fitness for purpose in a particular application. The levels required for a given application are to be found in regulations or non-conflicting standards.

Products with a declared thermal resistance lower than 0,40 $m^2 \cdot K/W$ or a declared thermal conductivity greater than 0,050 W/(m·K) at 10 °C are not covered by this standard.

This standard does not cover in-situ insulation products, products intended to be used for the insulation of building equipment and industrial installations or products intended for acoustic insulation.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 822, *Thermal insulating products for building applications – Determination of length and width.*

EN 823, *Thermal insulating products for building applications – Determination of thickness.*

EN 824, *Thermal insulating products for building applications – Determination of squareness.*

EN 825, *Thermal insulating products for building applications – Determination of flatness.*

EN 826, *Thermal insulating products for building applications – Determination of compression behaviour.*

EN 1602, *Thermal insulating products for building applications – Determination of apparent density.*

EN 1603, *Thermal insulating products for building applications – Determination of dimensional stability under constant normal laboratory conditions (25 °C / 50 % relative humidity).*

EN 1604, *Thermal insulating products for building applications – Determination of dimensional stability under specified temperature and humidity conditions.*

EN 1606, *Thermal insulating products for building applications – Determination of compressive creep.*

EN 1607, *Thermal insulating products for building applications – Determination of tensile strength perpendicular to faces.*

EN 1609, *Thermal insulating products for building applications – Determination of short term water absorption by partial immersion.*

EN ISO 4590, *Cellular plastics – Determination of volume percentage of open and closed cells of rigid materials (ISO 4590:1981).*

prEN ISO 9229, *Thermal insulation – Definitions of terms (ISO/DIS 9229:1997).*

prEN ISO 11925-2, *Reaction to fire tests for building products – Part 2: Ignitability when subjected to direct impingement of flame (ISO/DIS 11925-2:1998).*

EN 12086:1997, *Thermal insulating products for building applications – Determination of water vapour transmission properties.*

EN 12087, *Thermal insulating products for building applications – Determination of long term water absorption by immersion.*

EN 12089:1997, *Thermal insulating products for building applications – Determination of bending behaviour.*

EN 12429, *Thermal insulating products for building applications – Conditioning to moisture equilibrium under specified temperature and humidity conditions.*

prEN 12667, *Thermal performance for building materials and products – Determination of thermal resistance by means of guarded hot plate and heat flow meter methods – Products of high and medium thermal resistance.*

EN 12939, *Thermal performance for building materials and products – Determination of thermal resistance by means of guarded hot plate and heat flow meter methods – Thick products of high and medium thermal resistance.*

EN 13172:2001, *Thermal insulating products – Evaluation of conformity.*

prEN 13501-1, *Fire classification of construction products and building elements – Part 1 : Classification using test data from reaction to fire test.*

prEN 13823, *Reaction to fire tests for building products – Building products excluding floorings exposed to the thermal attack by a single burning item.*

ISO 12491, *Statistical methods for quality control of building materials and components.*

3 Terms, definitions, symbols, units and abbreviated terms

3.1 Terms and definitions

For the purposes of this standard, the following terms and definitions apply.

3.1.1 Terms and definitions as given in prEN ISO 9229

3.1.1.1
phenolic foam
rigid cellular foam, the polymer structure of which is made primarily from the polycondensation of phenol, its homologues and/or derivatives, with aldehydes or ketones

3.1.1.2
board; slab
rigid or semi-rigid (insulation) product of rectangular shape and cross section in which the thickness is uniform and substantially smaller than the other dimensions

NOTE Boards are usually thinner than slabs. They may also be supplied in tapered form.

3.1.1.3
laminate
combination of two or more materials that are bonded together during manufacture to produce a single item or product

3.1.2 Additional terms and definitions

3.1.2.1
level
the given value which is the upper or lower limit of a requirement. The level is given by the declared value of the characteristic concerned

3.1.2.2
class
a combination of two levels of the same property between which the performance shall fall

3.2 Symbols, units and abbreviated terms

Symbols and units used in this standard:

b	is the width	mm
d	is the thickness	mm
d_N	is the nominal thickness of the product	mm
ΔS	is the overall change in flatness	mm
$\Delta\varepsilon_b$	is the relative change in width	%
$\Delta\varepsilon_d$	is the relative change in thickness	%
$\Delta\varepsilon_l$	is the relative change in length	%
$\Delta\lambda_a$	is the ageing increment of thermal conductivity	W/(m·K)
$\Delta\lambda_s$	is the ageing increment of thermal conductivity as determined by the slicing method	W/(m·K)
ε_{ct}	is the compressive creep	%
ε_t	is the total thickness reduction	%
k	is a factor related to the number of test results available	–
k_a	is the number of test results of aged thermal conductivity	–
k_i	is the numnber of test results of initial thermal conductivity	–
l	is the length	mm
$\lambda_{90/90}$	is the 90 % fractile with a confidence level of 90 % for the thermal conductivity	W/(m·K)
λ_D	is the declared thermal conductivity	W/(m·K)
λ_i	is one test result of thermal conductivity	W/(m·K)
λ_{mean}	is the mean thermal conductivity	W/(m·K)
$\lambda_{mean,a}$	is the mean of the aged values of thermal conductivity	W/(m·K)
$\lambda_{mean,i}$	is the mean of the initial values of thermal conductivity	W/(m·K)
μ	is the water vapour diffusion resistance factor	–
n	is the number of test results	–
$R_{90/90}$	is the 90 % fractile with a confidence level of 90 % for the thermal resistance	m^2·K/W
R_D	is the declared thermal resistance	m^2·K/W
R_i	is one test result of thermal resistance	m^2·K/W
R_{mean}	is the mean thermal resistance	m^2·K/W
ρ_a	is the apparent density	kg/m^3
S_b	is the deviation from squareness on length and width	mm/m
S_d	is the deviation from squareness on thickness	mm
S_{max}	is the deviation from flatness	mm

s_R	is the estimate of the standard deviation of the thermal resistance	$m^2 \cdot K/W$
s_λ	is the estimate of the standard deviation of the thermal conductivity	$W/(m \cdot K)$
$s_{\lambda,a}$	is the estimate of the standard deviation of the aged values of thermal conductivity	$W/(m \cdot K)$
$s_{\lambda,i}$	is the estimate of the standard deviation of the initial values of thermal conductivity	$W/(m \cdot K)$
σ_b	is the bending strength	kPa
σ_c	is the compressive stress	kPa
σ_m	is the compressive strength	kPa
σ_{mt}	is the tensile strength perpendicular to faces	kPa
W_{lp}	is the long-term water absorption by partial immersion	kg/m^2
W_p	is the short-term water absorption	kg/m^2
Ψ_o	is the closed cell content (corrected)	%
Z	is the water vapour resistance	$m^2.h.Pa/mg$

AD	is the symbol of the declared value of apparent density
CC($i_1/i_2/y$)σ_c	is the symbol of the declared level of compressive creep
CS(Y)	is the symbol of the declared level of compressive strength
CV	is the symbol of the declared value of closed cell content
DS(T+)	is the symbol of the declared value of dimensional stability at specified temperature
DS(T-)	is the symbol of the declared value of dimensional stability at -20 °C
DS(TH)	is the symbol of the declared value of dimensional stability under specified temperature and humidity conditions
MU	is the symbol of the declared value of water vapour diffusion resistance factor
T	is the symbol of the declared class for thickness tolerance
TR	is the symbol of the declared level for tensile strength perpendicular to faces
WL(P)	is the symbol of the declared level for long term water absorption by partial immersion
WS	is the symbol of the declared level for short-term water absorption
Z	is the symbol of the declared value for the water vapour resistance

Abbreviated terms used in this standard:

PF	is **P**henolic **F**oam
ITT	is **I**nitial **T**ype **T**est

4 Requirements

4.1 General

Product properties shall be assessed in accordance with clause 5. To comply with this standard, products shall meet the requirements of 4.2, and the requirements of 4.3 as appropriate.

NOTE Information on additional properties is given in annex D.

One test result for a product property is the average of the measured values on the number of test specimens given in Table 7.

4.2 For all applications

4.2.1 Thermal resistance and thermal conductivity

Thermal resistance and thermal conductivity shall be based upon measurements carried out in accordance with prEN 12667 or EN 12939 for thick products.

The thermal resistance and thermal conductivity shall be determined in accordance with annex A and annex C and declared by the manufacturer according to the following:

– the reference mean temperature shall be 10 °C;

- the measured value shall be expressed with three significant figures;
- the thermal resistance, R_D, shall always be declared. The thermal conductivity, λ_D, shall be declared where possible;
- the declared thermal resistance, R_D, and thermal conductivity, λ_D, shall be given as limit values representing at least 90 % of the production, determined with a confidence level of 90 %;
- the value of thermal conductivity, $\lambda_{90/90}$, shall be rounded upwards to the nearest 0,001 W/(m·K) and declared as λ_D in levels with steps of 0,001 W/(m·K);
- the declared thermal resistance, R_D, shall be calculated from the nominal thickness, d_N, and the corresponding thermal conductivity, $\lambda_{90/90}$;
- the value of thermal resistance, $R_{90/90}$, when calculated from the nominal thickness, d_N, and the corresponding thermal conductivity, $\lambda_{90/90}$, shall be rounded downwards to the nearest 0,05 m^2·K/W and declared as R_D in levels with steps of 0,05 m^2·K/W;
- the value of $R_{90/90}$, for those products for which only the thermal resistance is measured directly, shall be rounded downwards to the nearest 0,05 m^2·K/W and declared as R_D in levels with steps of 0,05 m^2·K/W.

4.2.2 Length and width

Length, *l*, and width, *b*, shall be determined in accordance with EN 822. No test result shall deviate from the nominal values by more than the tolerances given in Table 1 for the corresponding dimensions.

Products with a surface facing or natural skin shall be tested without removing them.

Table 1 – Tolerances for length and width

Dimensions in millimetres

Dimensions	Length	Width
< 1250	± 5,0	± 3,0
1250 to 2000	± 7,5	± 7,5
2001 to 4000	± 10,0	not applicable
> 4000	± 15,0	not applicable

4.2.3 Thickness

Thickness, *d*, shall be determined in accordance with EN 823. No test result shall deviate from the nominal thickness, d_N, by more than the tolerance given in Table 2 for the labelled class.

Table 2 – Classes for thickness tolerances

Dimensions in millimetres

Nominal thickness	Tolerance	
	T1	T2
< 50	± 2,0	± 1,5
50 to 100	- 2,0 + 3,0	± 1,5
> 100	- 2,0 + 5,0	± 1,5

4.2.4 Squareness

Squareness shall be determined in accordance with EN 824. The deviation from squareness on length and width, S_b, shall not exceed 10 mm/m. The deviation from squareness on thickness, S_d, shall not exceed 2 mm.

4.2.5 Flatness

Flatness shall be determined in accordance with EN 825. The deviation from flatness, S_{max} , shall not exceed the tolerances given in Table 3 for the corresponding nominal thickness, d_N.

Table 3 – Tolerances for deviation from flatness

Dimensions in millimetres

Nominal thickness	Tolerance
< 50	≤ 10,0
50 to 100	≤ 7,5
> 100	≤ 5,0

4.2.6 Dimensional stability

4.2.6.1 Dimensional stability under constant normal laboratory conditions

Dimensional stability under constant normal laboratory conditions (23 °C/50 % relative humidity) shall be determined in accordance with EN 1603. The relative changes in length, $\Delta\varepsilon_l$, and width, $\Delta\varepsilon_b$, shall not exceed ± 0,5 %. The overall change in flatness, ΔS, shall not exceed the values given in Table 3 for the corresponding nominal thickness, d_N.

4.2.6.2 Dimensional stability under specified temperature and humidity conditions

Dimensional stability under specified temperature and humidity conditions shall be determined in accordance with EN 1604. The test shall be carried out after storage for 48 h at (23 ± 2) °C and (90 ± 5) % relative humidity. The relative changes in length, $\Delta\varepsilon_l$, and width, $\Delta\varepsilon_b$, shall not exceed ± 0,5 %. The relative change in thickness, $\Delta\varepsilon_d$, shall not exceed ± 1,5 %.

This test shall not be performed when the more severe test, described in 4.3.2.2.

4.2.7 Bending behaviour

The bending strength, σ_b, shall be determined in accordance with EN 12089. For handling purposes products shall have a bending strength greater than 200 kPa.

4.2.8 Reaction to fire

Reaction to fire classification (Euroclasses) shall be determined in accordance with prEN 13501-1.

4.3 For specific applications

4.3.1 General

If there is no requirement for a property described in 4.3 for a product in use, then the property does not need to be determined and declared by the manufacturer.

4.3.2 Dimensional stability under specified conditions

4.3.2.1 Dimensional stability at specified temperature

Dimensional stability at specified temperature shall be determined in accordance with EN 1604. The test shall be carried out after storage for 48 h at (70 ± 2) °C. The relative changes in length, $\Delta\varepsilon_l$, and width, $\Delta\varepsilon_b$, shall not exceed ± 1,5 %. The relative changes in thickness, $\Delta\varepsilon_d$, shall not exceed ± 3 %.

4.3.2.2 Dimensional stability under specified temperature and humidity conditions

Dimensional stability under specified temperature and humidity conditions shall be determined in accordance with EN 1604. The test shall be carried out after storage for 48 h at (70 ± 2) °C and (90 ± 5) % relative humidity. The relative change in length, $\Delta\varepsilon_l$, width, $\Delta\varepsilon_b$, and thickness, $\Delta\varepsilon_d$, shall not exceed ± 1,5 %.

4.3.2.3 Dimensional stability at - 20 °C

Dimensional stability at - 20 ºC shall be determined in accordance with EN 1604. The test shall be carried out after storage for 48 h at (- 20 ± 2) °C. The relative change in length, $\Delta\varepsilon_l$, width, $\Delta\varepsilon_b$, and thickness, $\Delta\varepsilon_d$, shall not exceed ± 1,5 %.

4.3.3 Compressive strength

Compressive strength, σ_m , shall be determined in accordance with EN 826. No test result for compressive strength, σ_m, shall be less than the value given in Table 4 for the declared level.

Table 4 – Levels for compressive strength

Level	Requirement kPa
CS(Y) 50	≥ 50
CS(Y) 100	≥ 100
CS(Y) 120	≥ 120
CS(Y) 150	≥ 150
CS(Y) 175	≥ 175
CS(Y) 200	≥ 200
CS(Y) 300	≥ 300
CS(Y) 400	≥ 400

4.3.4 Tensile strength perpendicular to faces

Tensile strength perpendicular to faces, σ_{mt} , shall be determined in accordance with EN 1607. The value of tensile strength perpendicular to faces shall be declared in levels, TR, with steps of 20 kPa. No test result shall be less than the declared level.

4.3.5 Point load

The effects of foot traffic shall be assessed by means of the determination of compressive strength in accordance with EN 826 (see 4.3.3).

4.3.6 Compressive creep

Compressive creep, ε_{ct}, and total thickness reduction, ε_t, shall be determined after at least one hundred and twenty two days of testing at a declared compressive stress, σ_c, given in steps of at least 1 kPa and the results extrapolated thirty times to obtain the declared levels in accordance with EN 1606. Compressive creep shall be declared in levels, i_2, and the total thickness reduction shall be declared in levels, i_1, with steps of 1 % at the declared stress. No test result shall exceed the declared levels at the declared stress.

NOTE 1 Examples for declaration of levels for compressive creep

Level	Test time days	Extrapolation time years	Declared stress kPa	Requirement %
CC (i_1/i_2 %/10) σ_c	122	10	σ_c	$i_1/i_2 \leq i$
CC (i_1/i_2 %/25) σ_c	304	25	σ_c	$i_1/i_2 \leq i$
CC (i_1/i_2 %/50) σ_c	608	50	σ_c	$i_1/i_2 \leq i$