SLOVENSKI STANDARD
oSIST prEN 17140:2017

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Toplotnoizolacijski proizvodi za stavbe - Industrijsko izdelani vakuumski izolacijski paneli (VIP) - Specifikacije

Thermal insulation products for buildings - Factory made Vacuum Insulation Panels (VIP) - Specification

Wärmedämmstoffe für Gebäude - Werksmäßig hergestellte Vakuumisolationspanele (VIP) - Spezifikation

Produits isolants thermiques pour le bâtiment - Panneaux Isolants sous Vide produits de façon industrielle (VIP) - Spécification

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91.100.60	Materiali za toplotno in zvočno izolacijo	Thermal and sound insulating materials

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Thermal insulation products for buildings - Factory made Vacuum Insulation Panels (VIP) - Specification

Produits isolants thermiques pour le bâtiment - Panneaux Isolants sous Vide produits de façon industrielle (PIV) - Spécification

Wärmedämmstoffe für Gebäude - Werksmäßig hergestellte Vakuumisolationspanele (VIP) - Spezifikation

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 17140:2017) has been prepared by Technical Committee CEN/TC 88 “Thermal insulating materials and products”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document 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.

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this document.

1 Scope

This standard defines requirements for factory made Vacuum Insulation Panels (VIP), which are used for the thermal insulation of buildings. This standard describes the product properties and contains test methods and rules for conformity evaluations, identification and labelling. The determination of VIP properties influencing the service life time and VIP performance is content of this standard as well. The standard provides a test method to determine the ageing of the product including the influence of the linear thermal bridges at the edges.

This standard is applicable for all types of VIP independent of the core material or type of envelope. It is also applicable for VIP using desiccants but not getters, due to a lack of experience with ageing of these panels.

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 can be found in regulations or non-conflicting standards.

Products with a declared thermal resistance R_D lower than 0,5 m^2 K/W or a declared thermal conductivity λ_D according to Annex C of this Standard greater than 0,015 W/(m·K) are not covered by this standard.

This standard does not cover products intended to be used for the insulation of building equipment and industrial installations.

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 822, *Thermal insulating products for building applications - Determination of length and width*

EN 823:2013, *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 1604, *Thermal insulating products for building applications - Determination of dimensional stability under specified temperature and humidity conditions*

EN 1605, *Thermal insulating products for building applications - Determination of deformation under specified compressive load and temperature conditions*

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

EN 12667, *Thermal performance of 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 13172, *Thermal insulation products - Evaluation of conformity*

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

EN ISO 10456, *Building materials and products - Hygrothermal properties -Tabulated design values and procedures for determining declared and design thermal values (ISO 10456)*

ISO 8302, *Thermal insulation — Determination of steady-state thermal resistance and related properties — Guarded hot plate apparatus*

3 Terms and definitions, symbols, units and abbreviated terms

3.1 Terms and definitions

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

3.1.1
Vacuum Insulation Panel
VIP
insulation element containing a core material with open porosity within an envelope; where the inner pressure inside the envelope is lower than the ambient air pressure

3.1.2
centre of panel
COP
area of the VIP not affected by the edge effect

3.1.3
edge effect
form of thermal bridging along the edge due to the higher thermal conductivity of the outer envelope compared to the core

3.1.4
inner pressure
total gas pressure within the VIP, measured in mbar

3.1.5
pressure compensation method
method of testing inner pressure of VIP using a laminate -lift-off technique with a vacuum chamber or suction bell

Note 1 to entry: In some literature also called foil-lift-off technique.

3.1.6
vacuum chamber
device to evacuate a VIP or a volume around a VIP to determine the inner pressure of a VIP by the pressure compensation method

3.1.7
suction bell
alternative device to evacuate a volume connected to a part of a VIP to determine the inner pressure of a VIP by the pressure compensation method

3.1.8
pressure sensor
device to measure the inner pressure of a VIP

3.1.9
core material
open porous insulation material constituting the main component inside the VIP envelope

3.1.10
envelope
outer layer of the VIP securing the vacuum inside the VIP

3.1.11
desiccant
material different from the core material that is added inside the envelop to absorb respectively adsorb water vapour

3.2 Symbols and abbreviated terms

For the purpose of this document, the following symbols and units apply.

A	the surface area of the VIP	m^2
A_m	the metering area of the GHP or HFM apparatus used for the measurement	m^2
A_N	the nominal surface area of the VIP	m^2
b	the width	m
d	the thickness	m
$d_{ambient}$	the thickness of the ventilated VIP	m
d_N	the nominal thickness of the product	m
d_{VIP}	the thickness of the VIP	m
f_{air}	the acceleration factor for dry air of the VIP envelope	–
f_v	the acceleration factor for water vapour of the VIP envelope	–
k	a factor related to the number of test results available	–
l	the length	M
l_c	core length	m
l_w	working length	m
l_ψ	the length of the joints within the metering area	M
N	the number of test results	–
P_{air}	the air permeability of the VIP envelope	m^3 Pa/ (m^2·s)
P_v	the water intake rate of the VIP envelope	kg/(m^2·s)
p_{air}	air pressure inside the VIP	Pa
p_{lim}	the maximum value of the inner pressure measured at least 24 h after production	Pa
p_v	water vapour pressure inside the VIP	Pa
p_0	the initial value of the inner pressure	Pa

$p_{1/2}$	the inner pressure of VIP, where λ increases by 1/2 of the thermal conductivity of still air.	Pa
R_{aux}	thermal resistance of the auxiliary material	m^2·K/W
$R_{COP,90/90aged}$	$R_{90/90}$ at centre of panel plus ageing	m^2·K/W
R_D	the declared thermal resistance including ageing and edge-effect	m^2·K/W
R_{mean}	the mean thermal resistance	m^2·K/W
R_i	one test result of thermal resistance	m^2·K/W
R_{tot}	thermal resistance of VIP plus auxiliary material	m^2·K/W
$R_{90/90}$	the 90 % fractile with a confidence level of 90 % for the thermal resistance	m^2·K/W
S	the top surface area (working length x working width) of the VIP	m^2
S_b	the deviation from squareness on width or length	mm/m
S_{max}	the deviation from flatness	mm
S_N	the nominal perimeter of the product	m
s_R	the estimate of the standard deviation of the thermal resistance	m^2·K/W
s_λ	the estimate of the standard deviation of the thermal conductivity	W/(m·K)
$s_{\lambda i}$	the estimate of the standard deviation of the initial thermal conductivity within 90 days of production	W/(m·K)
T	the temperature	K
t	the time	s
t_{Des}	lifetime of the desiccant	a
w_c	core width	m
w_w	working width	m
X	water content inside the VIP	mass-%
$\lambda_{ambient}$	the thermal conductivity of a ventilated VIP at centre of the panel	W/(m·K)
λ_{COP}	the thermal conductivity for centre of panel	W/(m·K)
$\lambda_{COP,mean}$ (25years)	the average value of thermal conductivity over the first 25 years in use at centre of panel	W/(m·K)
$\lambda_{COP,90/90,aged}$	$\lambda_{90/90}$ at centre of panel plus ageing	W/(m·K)
λ_D	the declared thermal conductivity including ageing and edge-effect	W/(m·K)
$\lambda_{eq\ ja}$	the equivalent thermal conductivity including edge effects for the specific joint assembly	W/(m·K)
λ_{mean}	the mean value of thermal conductivity	W/(m·K)
λ_i	one test result of thermal conductivity	W/(m·K)

λ'_p	the change of thermal conductivity with pressure	W/(m·K·Pa)
λ'_t	the change of thermal conductivity with time	W/(m·K·s)
λ_{VIP}	the thermal conductivity of the VIP	W/(m·K)
λ'_X	the change of thermal conductivity with humidity	W/(m·K)/mass-%
$\lambda_{90/90}$	the 90 % fractile with a confidence level of 90 % for the thermal conductivity	W/(m·K)
$\lambda'_{t, 23, 50}$	the change of thermal conductivity with time at 23°C 50 % RH	W/(m·K· a)
$\lambda'_{t, 50, 70}$	the change of thermal conductivity with time at 50°C 70 % RH	W/(m·K· a)
$\lambda(t)$	time-dependent thermal conductivity value	W/(m·K)
$\lambda(t)_{, 23, 50}$	the time dependent value of thermal conductivity at 23°C 50 % RH	W/(m·K)
λ^* (t = 0)	the interpolated initial value of thermal conductivity	W/(m·K)
σ_{mt}	the tensile strength perpendicular to faces	kPa
σ_{10}	the compressive stress at 10 % deformation	kPa
Φ	relative humidity inside the VIP	%
Φ'_X	the change of relative humidity inside the VIP as function of water content	(rel. humidity-%)/(mass-%)
Ψ	the linear thermal transmittance	W/(m·K)
ψ_m	the linear thermal transmittance for the joints in the metering area	W/(m·K)

Abbreviated terms used in this standard:

VIP is **V**acuum **I**nsulation **P**anel

COP is **C**enter **O**f **P**anel

AVCP is **A**ssessment and **V**erification of **C**onstancy of **P**erformance (previously named attestation of conformity)

DoP is **D**eclaration **o**f **P**erformance

FPC is **F**actory **P**roduction **C**ontrol

PTD is **P**roduct **T**ype **D**etermination (previously named ITT for Initial Type Test)

STP is **S**tandard condition for **T**emperature and **P**ressure

RtF is **R**eaction **t**o **F**ire

ThIB is **Th**ermal **I**nsulation for **B**uildings

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.

One test result for a product property is the average of the measured values on the number of test specimens given in Table 6.

The ageing and edge effect are dealt with in Annex C.

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 at centre of panel in accordance with EN 12667. In case of dispute ISO 8302 shall be applied.

For VIP the thermal resistance and thermal conductivity including ageing shall be determined in accordance with Annex A and including ageing and thermal bridge effect according to Annex C and shall be declared by the manufacturer according to the following:

— The reference mean temperature for thermal conductivity shall be 10 °C, outside Europe the reference mean temperature 23 °C or 24 °C shall be used.

— The measured values shall be expressed with three significant figures.

— For products of uniform thickness, the declared 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 the declared thermal conductivity, λ_D, shall be derived from $\lambda_{90/90}$ by adding ageing and edge effects according to Annex C.

— The declared thermal conductivity λ_D is achieved including ageing and edge effect according to Annex C and shall be rounded upwards in steps of 0,0005 W/(m·K).

— $\lambda_{90/90}$ is obtained from testing thermal conductivity in the centre of panels shortly after production. It shall be representing at least 90 % of the production, determined with a confidence level of 90 % in accordance with EN ISO 10456.

— The statistical value of thermal conductivity, $\lambda_{90/90}$, shall be rounded upwards to the nearest 0,0001 W/(m·K).

— The declared thermal resistance, R_D, shall be calculated from the nominal thickness, d_N, and the corresponding thermal conductivity value λ_D, and shall be rounded downwards to the nearest 0,05 m^2·K/W.

4.2.2 Inner pressure

The inner pressure of the panel shall be measured minimum 24 h after production according to Annex G and shall be lower than the declared limit value p_{lim}.