ISO/TC 163/SC N

Date: 2014-05-23

ISO/WD 16478.3

ISO/TC 163/SC /WG

Secretariat: SIS

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

Produits isolants thermiques pour le bâtiment — Produits manufacturés en laine vacuum isolation panel (VIP) — Spécification

6th draft

Contents (will actualized when document is finalized)

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Foreword

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

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

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

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

ISO 16478 was prepared by Technical Committee ISO/TC 163, *Thermal performance of buildings*, Subcommittee SC , and by Technical Committee CEN/TC 88, *Thermal insulation products* in collaboration.

This second/third/... edition cancels and replaces the first/second/... edition (), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

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

1 Scope

This International standard defines requirements for factory made vacuum insulation panels (VIPs), 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 aging of the product including the influence of the linear thermal bridges at the edges.
This standard is applicable for all types of VIP panels independent of the core material.

Vacuum Insulation Sandwich Elements (VISE) are not included but dealt in a separate standard.

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 0,5 m²·K/W or a declared effective thermal conductivity according to Annex C of this Standard greater than 0,020 W/(m·K) at 10 °C 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, *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 1604:1996. Thermal insulating products for building applications. Determination of dimensional stability under specified temperature and humidity conditions
EN 1605:1997. Thermal insulating products for building applications. Determination of deformation under specified compressive load and temperature conditions
EN 1607:1997. 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 hotplate and heat flow meter methods – Products of high and medium thermal resistance*
EN 13501-1, *Fire classification of construction products and building elements – Part 1: Classification using test data from reaction to fire test*
EN 15715, *Thermal insulation products – Instructions for mounting and fixing for reaction to fire testing – Factory made products*
EN ISO 10211 *Thermal bridges in building construction - Heat flows and surface temperatures - Part 1: General calculation methods*
EN ISO 10456*, Building materials and products – Hygrothermal properties – Tabulated design values and procedures for determining declared and design thermal values*
ISO 8302, *Thermal insulation - Determination of steady-state thermal resistance and related properties - Guarded hot plate apparatus*

Kommentar [JD1]: EN version of ISO 29764

Kommentar [JD2]: EN version of ISO 29765

ISO 29472, *Thermal insulating products for building applications - Determination of dimensional stability under specified temperature and humidity conditions*
ISO 29764 *Thermal insulating products for building applications - Determination of deformation under specified compressive load and temperature condition*
ISO 29765, *Thermal insulating products for building applications - Determination of tensile strength perpendicular to faces*
Normative references to be revised when finished

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)
An insulation element containing a core material with open porosity within an envelope; where the internal pressure inside the envelope is lower than the ambient air pressure

3.1.2
Edge effect
Form of thermal bridging along the edge due to the higher thermal conductivity of the outer envelope compared to the core

3.2 Symbols and abbreviated terms

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

A	is the area	m²
A_N	is the nominal area of the product	m²
b	is the width	m
d	is the thickness	m
d_{aux}	is the thickness of the auxiliary material	m
d_N	is the nominal thickness of the product	m
d_{tot}	is the total thickness of the sandwich helper material and VIP	m
d_{VIP}	is the thickness of the VIP	m
$\Delta\varepsilon_b$	is the relative change in width	%
$\Delta\varepsilon_d$	is the relative change in thickness	%
$\Delta\varepsilon_l$	is the relative change in length	%
ε_t	is the total relative thickness reduction	%
i	is the safety factor for the limit value of thermal conductivity	%
k	is a factor related to the number of test results available	–
l	is the length	m
$\lambda_{90/90}$	is the 90 % fractile with a confidence level of 90 % for the thermal	W/(m·K)
$\lambda_{90/90ae}$	is $\lambda_{90/90}$ including ageing and edge effects	W/(m·K)
λ_D	is the declared thermal conductivity	W/(m·K)
λ_{aux}	is the thermal conductivity of the auxiliary material	W/(m·K)
λ_{eff}	effective thermal conductivity	W/(m·K)
λi	is one test result of thermal conductivity	W/(m·K)
λ_{mean}	is the mean value of thermal conductivity	W/(m·K)
$\lambda_{mean,a}$	is the mean thermal conductivity after ageing	W/(m·K)
λ_p	pressure-dependent increase of thermal conductivity	W/(m·K)
λ_{tot}	is the total thermal conductivity of the sandwich auxiliary material and	W/(m·K)
λ_{VIP}	is the thermal conductivity of the VIP	W/(m·K)
$\lambda_{\chi w}$	humidity-dependent increase of thermal conductivity	W/(m·K)/mass-
$\lambda(\tau)$	time-dependent thermal conductivity value, format dependent	W/(m·K)
$X_{w,eq}$	compensation humidity 23°C, 50 % relative humidity	mass-%
X_{wa}	annual increase of humidity inside VIP	mass-%/ a
N	is the number of test results	
p_0	is the initial value of the inner pressure	bar
PL	is the limit value of the inner pressure after 24 hours	mbar
p_a	annual increase of internal pressure of VIP	bar/a
Q_L	is the leakage rate	
$R_{90/90}$	is the 90 % fractile with a confidence level of 90 % for the thermal	m^2·K/W
$R_{90/90ae}$	is $R_{90/90}$ including ageing and edge effects	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
(S	is the surface	mm
S_N	is the nominal perimeter of the product	m
S_b	is the deviation from squareness on width or length	mm/m
S_{max}	is the deviation from flatness	mm
s_R	is the estimate of the standard deviation of the thermal resistance	m^2·K/W
s_λ	is the estimate of the standard deviation of the thermal conductivity	W/(m·K)

Kommentar [bs3]:
, a can be misleading, a was used fo anual values in literature on VIPs better here is
Δλmean, 12.5a for the mean increase in thermal conductivity after ageing calculated as average of the first 25 years for the years 12.5
(with a for Annum)

Kommentar [bs4]:
The pL with small p and L in index would better fit to p0 and pa

Kommentar [bs5]:
pi is the inner pressure measured during an aging experiment
mbar
(pi with i in index, it is needed to calculate pa.
evt pH20 for inner water vapor partial pressure has to be added too. As in CEN-TC88-WG11_N0064_Methods_to_obtain_declared_value_ Caps2014 .pdf
and p_air which is measured as the difference pi-pH20 using the assumtion of the sorption isotherm. Such a difference calculation can can lead to quite big deviations, and p_air not smaller 0.5 pi is on the save side.)

Kommentar [JD6]: Should this be perimeter ? It has not been referenced

$s_{\lambda,a}$	is the estimate of the standard deviation of the aged thermal conductivity	W/(m·K)
$s_{\lambda,i}$	is the estimate of the standard deviation of the initial thermal conductivity	W/(m·K)
t	time	a
t_{sl}	service life time	a
T	Temperature	°C or K
τ	= $X_{w,eq}$ / X_{wa} , time constant humidity compensation	mass-%/(mass-%/a)
σ_{10}	is the compressive stress at 10% deformation	kPa
σ_{mt}	is the tensile strength perpendicular to faces	kPa
Ψ	linear thermal transmittance	W/(m·K)

Symbols to be proved by DIN

Abbreviated terms used in this standard:
VIP is **V**acuum **I**nsulation **P**anel
AVCP is **A**ssessment and **V**erification of **C**onstancy of **P**erformance (previously named attestation of conformity)
DoP is **D**eclaration of **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)
RtF is **R**eaction to **F**ire
ThIB is **T**hermal **I**nsulation for **B**uildings
VCP is **V**erification of **C**onstancy of **P**erformance (previously named evaluation of conformity)

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 46.

Formatiert: Leerraum zwischen asiatischem und westlichem Text nicht anpassen, Leerraum zwischen asiatischem Text und Zahlen nicht anpassen

The aging and edge effect are dealt with in Annex C

4.2 For all applications

4.2.1 Thermal resistance and thermal conductivity

4.2.1.1 Basic measurement

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 VIPs the thermal resistance and thermal conductivity including aging shall be determined in accordance with annex A and including aging and thermal bridge effect according to annex C and shall be declared by the manufacturer according to the following:

— the reference mean temperature shall be 10 °C, outside Europe the reference mean temperature 24 °C has to 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, λD, shall be given as limit values representing at least 90 % of the production, determined with a confidence level of 90 % in accordance with EN ISO 10456 or as limit value.
- the statistical value of thermal conductivity, λ90/90, shall be rounded upwards to the nearest 0,0001 W/(m·K).
- the λD is achieved including aging and edge effect according to Annex C and shall be declared in steps of 0,0005 W/(m·K).
- the declared thermal resistance, *R*D, shall be calculated from the nominal thickness, *d* N ,and the corresponding thermal conductivity value, and shall be rounded downwards to the nearest 0,05 m²·K/W.

4.2.1.2 Thermal conductivity of the punctured VIP under ambient pressure due to damage

The thermal resistance and thermal conductivity of a punctured VIP shall be recorded upon measurements in accordance with EN 12667. To this extend the envelope of the VIP shall be opened at the edge.

The thermal resistance and thermal conductivity shall be determined according to the following:

- The length or diameter of the opening shall be between 10 mm and 20 mm;
- The measurement shall be done after conditioning according to 5.2.

The edge effect measured or modelled with non-punctured VIP according to C.5 should be used to calclulate the effective thermal conductivity and thermal resistance of the punctured VIP.

Formatiert: Schriftartfarbe: Automatisch

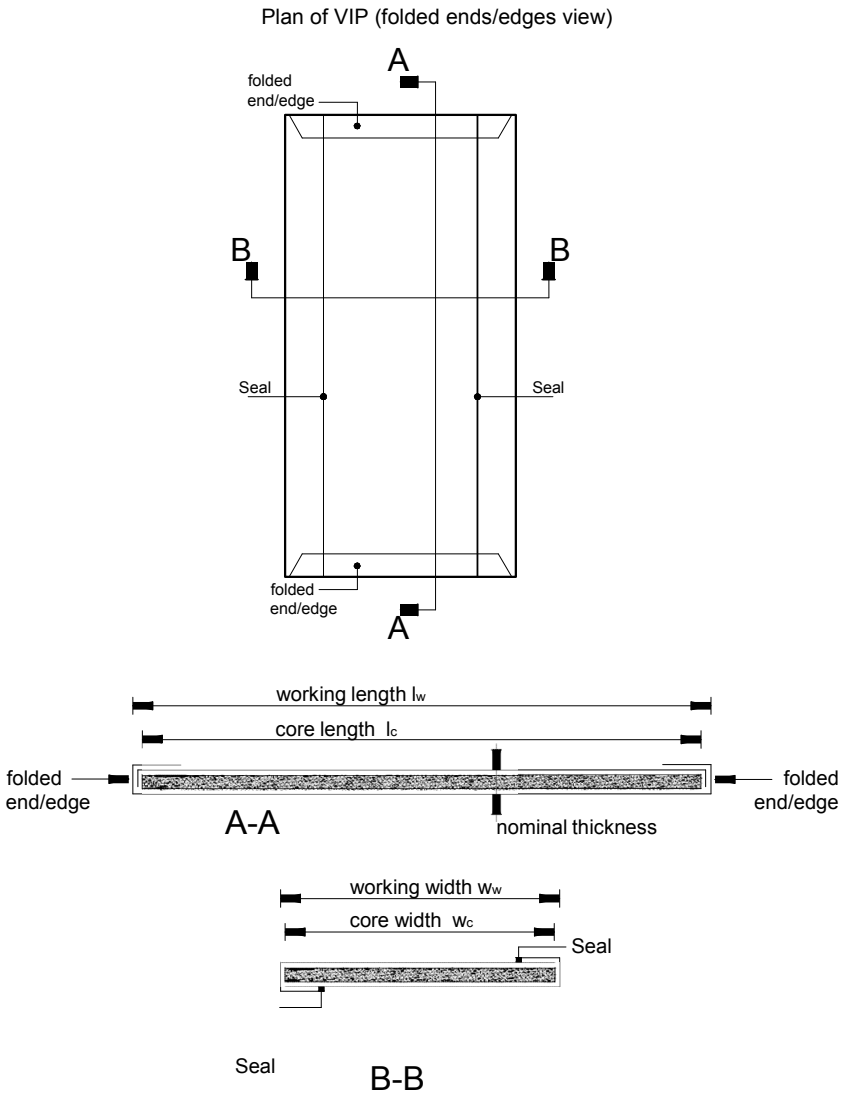
4.2.2 Internal pressure at least 24 hours after production

The internal pressure of the panel shall be determined at least 24 h after production according to one of the method described in Annex D.

4.2.3 Length, width, squareness, flatness

Length, *l*, and width, *b*, shall be determined in accordance with EN 822, the deviation from squareness on length and width, S_b, in accordance with EN 824, and the deviation from flatness, S_{max}, in accordance with EN 825. No test result shall deviate from the nominal values by more than the tolerances given in Table 1.

Formatiert: Nicht Hervorheben



~~NEW~~ FIGURE 1: VIP dimensions

Table 1 — Tolerances of length, width, squareness and flatness

Tolerances				
Length or width			Squareness on length and width	Flatness
< 500 mm	500≤(l,w) ≤ 1000	➢ 1000	S_b	S_{max}
mm			mm/m	%
8 (e.g. +2 / -6) Or (e.g. +0 / -8)	10 (e.g. ± 5) Or (e.g. +4 / -6)	12 (e.g. +4 / -8) Or (e.g. +10 / -2)	5	0,6 (6 mm/m)

4.2.4 Thickness

Thickness, *d*, shall be determined in accordance with EN 823.

Table 2 — Range of Tolerances for thickness

Tolerances		
Thickness	Range of tolerance	Example
mm	mm	*mm*
≤ 20	2	± 1 or +0/-2
20 < t ≤ 30	3	+ 1/-2 or +2/-1
> 30	4	± 2 or +1/-3

4.2.5 Reaction to fire

For Europe reaction to fire classification shall be determined in accordance with EN 13501-1, mounting and fixing procedure for reaction to fire tests is given in Annex E.

Note: It is recognized that there is a need to consider the burning characteristics of these materials in their intended application. Therefore, until an International Standard is available, individual national rules should be followed.

4.2.6 Durability Characteristics

4.2.6.1 General

The durability characteristics have been considered and are covered in 4.2.6.2.

4.2.6.2 Durability of thermal resistance against ageing/ degradation

The thermal resistance and thermal conductivity of VIP can change with time. This effect is taken into account according to Annex C.

4.3 For specific applications

4.3.1 General

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

4.3.2 Dimensional stability under specified temperature and humidity conditions

Dimensional stability under specified temperature or under specified temperature and humidity conditions shall be determined in accordance with ISO 29472 or EN 1604. The test shall be carried out at 70°C and 90 % relative humidity.
The relative changes in length and width shall not exceed 1%, and the relative reduction in thickness shall not exceed 3%.

4.3.3 Deformation under specified compressive load and temperature conditions

Deformation under specified compressive load and temperature conditions shall be determined in accordance with ISO 29764 or EN 1605. The conditioning shall be carried out at 40 kPa and 70°C. The relative changes in thickness shall not exceed 3%.

4.3.4 Compressive stress at 10 % compressibility

Compressive stress at 10 % deformation, σ_{10}, or the compressive strength, σ_m, shall be determined in accordance with EN 826. No test result for either the compressive stress at 10 % deformation, σ_{10}, or the compressive strength, σ_m, whichever is the smaller, shall be less than the declared level, CS(10\Y), given in Table 3.

Table 3 — Levels for compressive stress or compressive strength

Level	Requirement kPa
CS(10\Y)50	≥ 50
CS(10\Y)75	≥ 75
CS(10\Y)100	≥ 100
CS(10\Y)125	≥125
CS(10\Y)150	≥ 150
CS(10\Y)175	≥175
CS(10\Y)200	≥ 200
CS(10\Y)225	≥225
CS(10\Y)250	≥ 250

The test may be omitted when manufacturing VIPs which, by their very nature, are only slightly compressible or not compressible at all. The highest class should be declared for such elements.

4.3.5 Tensile strength perpendicular to faces

Tensile strength perpendicular to faces, σ_{mt},, shall be determined in accordance with EN 1607. No test result shall be less than the value given in Table ~~3~~ 4 for the declared level.

Table 4 – Levels for tensile strength, perpendicular to faces

Level	Requirement kPa
TR30	≥ 30
TR40	≥ 40
TR50	≥ 50
TR60	≥ 60
TR70	≥ 70
TR80	≥ 80
TR90	≥ 90
TR100	≥ 100

4.3.6 Compressive creep

Compressive creep, X_{ct}, and total thickness reduction, X_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 shall be extrapolated thirty times, corresponding to ten years, to obtain the declared level in accordance with EN 1606. Compressive creep shall be declared in levels, i_2, and total thickness reduction shall be declared in levels, i_1, with steps of 0,1 mm at the declared stress. No test result shall exceed the declared level at the declared stress.

NOTE 1 Referring to the designation code CC(i_1/i_2/y)σ_c, according to Clause 6, a declared level CC(2,5/2/10)50, for example, indicates a value not exceeding 2 mm for compressive creep and 2,5 mm for total thickness reduction after extrapolation at 10 years (i.e. 30 times one hundred twenty two days of testing) under a declared stress of 50 kPa.

NOTE 2 Testing Times: According to EN 1606 the procedure at 10, 25 and 50 years respectively require the following testing times:

Table 5 – Extrapolation and minimum testing time

Extrapolation time years	Minimum testing time days
10	122
25	304
50	608

Formatiert: Englisch (USA), Nicht Erweitert durch / Verdichtet durch

Formatiert: Standard

4.3.7 Water vapour transmission

It is considered not possible to test water vapour transmission through VIP.

NOTE The permeability of the installed product may take into account the junction between the panels

4.3.8 Release of dangerous substances

National regulations on dangerous substances may require verification and declaration on release, and sometimes content, 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 web site on EUROPA accessed through:

http://ec.europa.eu/enterprise/construction/cpd-ds/

4.3.9 Shear strength

Shear strength, τ, shall be determined in accordance with EN 12090. If the shear stress is declared, no test result shall be less than the declared value, SSi.

4.3.10 Durability of thermal resistance against high temperature

The declared value of thermal conductivity shall be based on the value obtained per 4.2.6.2 respective in Annex C and the maximum application temperature of the VIP shall be declared as the maximum application temperatures experienced during the durability test protocol.

If the panel is to have a declared temperature range beyond the temperatures cited in 4.2.6.2 respective in Annex C, then the VIP will have to be subjected to 180 days at the extreme temperature followed by measuring the thermal conductivity. The thermal conductivity value for the VIP in that temperature extreme will then be reported. The declared thermal conductivity at the high temperature will be the greater of the two determinations.

This ageing procedure assumes that the increase in thermal conductivity is only dependent on the increase of air pressure inside the element. Initial state measurement of thermal conductivity shall be carried out according to EN 12667 and initial state measurement of internal pressure (p0) according to Annex D.

Kommentar [kos7]: Needs to be changed in accordance to Annex C.

Three VIPs with minimum of 300mm x 300mm x 20mm minimum nominal thickness shall be subjected to the ageing and testing procedure

Place the three VIP specimens at the declared temperature for 180 days. After 180 days the thermal conductivity of the VIP Panel shall be measured in accordance with EN 12667. The value obtained shall be reported along with the temperature of aging.

Kommentar [bs8]:
(in an oven, so at dry conditions.

Additional measurements of thermal conductivity measurements in accordance with EN 12667 can be carried out, e.g. after the first 90 days of storage at the elevated temperature.

Kommentar [bs9]:
and with approximative humidity and temperature of the lab where the oven is placed to allow to guess the partial water vapor pressure. Further the sample weight before and after shall be recorded.

(as partial water vapor pressure in the oven can vary strongly between cold winter lab conditions and up to a lab at tropical conditions)

isn't it, that that many core (with inner pressure at 2mbar (or more) further lose weight. There are data of Brunner2003 and somebody should add newer ones which include TC Thermal conductivity.)

5 Test methods

5.1 Sampling

Sufficient specimens shall be taken in accordance with the test methods.

5.2 Conditioning

Conditioning of the test specimens shall be at least 24h at (23 ± 5) °C unless otherwise specified in the test standard. In case of dispute, the test specimens shall be stored at (23 ± 2) °C and (50 ± 5) % relative humidity for at least 24 h prior to testing.

NOTE Conditions for hot countries?

Formatiert: Hervorheben

((From ISO 29471/Amd1)):
In tropical countries, the temperature and humidity can be (27 ± 2) °C and (65 ± 5) % relative humidity and this shall be stated clearly in the test report.

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5.3 Testing

5.3.1 General

Table ~~4~~ 6 gives the dimensions of the test specimens, the minimum number of measurements required to get one test result and any specific conditions which are necessary.

Unlike other insulating materials, VIPs cannot be cut to the sizes required by the test standards. They shall be produced in the sizes stated in Table ~~4~~6.

5.3.2 Thermal resistance and thermal conductivity

For CE-Marking: Thermal resistance and thermal conductivity of the VIP shall be determined in accordance with EN 12667 and under the following conditions:

– at a mean temperature of (10 ± 0,3) °C;
– after conditioning in accordance with 5.2;;
– taking into account aging and edge effect according to Annex C.

NOTE For other countries: Thermal resistance and thermal conductivity may also be measured at mean temperatures other than 10 °C, providing that the accuracy of the relationship between temperature and thermal properties is well documented

The measurement may be carried out directly on the VIP, or, for uneven surfaces, to avoid air gaps, the measurement may be carried out with the VIP positioned between two flexible contact sheets of another insulation material of known thermal conductivity (“auxiliary material”). The thermal conductivity λ_{VIP} can be calculated from the total thermal resistance R_{tot} of the composite, the thermal resistance ~~-~~of the auxiliary material R_{aux} and the measured thicknesses of VIP d_{VIP} and auxiliary material d_{aux}:

$$\lambda_{VIP} = \frac{d_{VIP}}{\left(R_{tot} - R_{aux}\right)} \quad (1)$$

Table 46 — Test methods, test specimens and conditions

Clause		Test method	Test specimen length and width[a]	Minimum number of measurements to get one test result	Specific conditions
No	**Title**				
4.2.1	Thermal resistance and thermal conductivity	EN 12667	≥ 300	1	See Annex C
4.2.2	Inner Pressure at least 24 h after production	See Annex D	≥ 300	1	See Annex D
4.2.3	Length and width	EN 822	Full-size	1	–
4.1.3	Squareness on length and width	EN 824	Full-size	1	–
4.2.3	Flatness	EN 825	Full-size	1	–
4.2.4	Thickness	EN 823	Full-size	1	Load (250 ± 5)Pa
4.2.5	Reaction to fire of the product as placed on the market	See EN 13501-1 and EN 15715	See clause 5 of EN 15715:2009	See EN 13501-1	–
4.3.2	Deformation stability according to specified temperature conditions	EN 1604	≥ 200	3	per clause 5.2
4.3.3	Deformation under specified compressive load and temperature conditions	EN 1605	≥ 200	3	per clause 5.2
4.3.4	Compressive stress or compressive strength	EN 826	≥ 200	3	per clause 5.2
4.3.5	Tensile strength perpendicular to faces	EN 1607	≥ 200	3	per clause 5.2
4.3.6	Compressive creep	EN 1606	≥200	3	per clause 5.2
4.3.9	Shear strength	EN 12090	200 x 100	3	per clause 5.2

Kommentar [bs10]: also in 4.2.3

6 Designation code

A designation code for the product shall be given by the manufacturer. The following shall be included except when there is no requirement for a property described in 4.3.

The Vacuum Insulation Panel abbreviated term	VIP
This document number	EN ISO xxx
Thickness tolerances	Ti
Dimensional stability under specified temperature and humidity conditions	DS
Compressive creep	$CC(i_1/i_2/y)\sigma_c$
Tensile strength	TRi
Shear strength	SSi
Flatness	FWi
Limit value of the inner pressure after 24 h	IP
Compressive stress or compressive strength	CS(10\Y)

The designation code for a Vacuum insulation product is illustrated by the following example:
EXAMPLE 1 VIP — EN ISO xxx — T — DS — CC(i1/i2/y) – Ssi – FWi - — IP — TR90

NOTE The characteristics determined in 4.2 are not included in the designation code if a limit value (threshold value) is given for the product

7 Assessment and Verification of the Constancy of Performance (AVCP)

7.1 General

The manufacturer or his authorised representative shall be responsible for the conformity of his product with the requirements of this European Standard. The Assessment and Verification of Constancy of Performance (AVCP) shall be carried out in accordance with EN 13172 and shall be based on Product Type Determination (PTD), Factory Production Control (FPC) by the manufacturer, including product assessment and tests on samples taken at the factory.
The compliance of the product with the requirements of this standard and with the stated values (including classes) shall be demonstrated by:

— Product Type Determination (PTD),

— Factory Production Control by the manufacturer, including product assessment.

If a manufacturer decides to group his products, it shall be done in accordance with EN 13172.

7.2 Product Type Determination (PTD)

All characteristics defined in 4.2 and those in 4.3 if declared, shall be subject to Product Type Determination (PTD) in accordance with Annex B of this standard.

7.3 Factory Production Control (FPC)

The minimum frequencies of tests in the factory production control (FPC) shall be in accordance with Annex B of this standard. When indirect testing is used, the correlation to direct testing shall be established in accordance with EN 13172.

8 Marking and labeling

Products conforming to this standard shall be marked clearly, either on the product or on the label or on the packaging, with the following information:

— product name or other identifying characteristic[1];

— name or identifying mark and address of the manufacturer or his authorised representative;

— shift or time of production or traceability code[1];

— reaction to fire class of the product as placed on the market. This classification shall be in accordance with 4.2.6;

— If reaction to fire tests on standardised assemblies have been performed according to Clause 6 of EN 15715:2009, then the reaction to fire classification shall be added and identified with the designation "standardised assembly no. x" after the classification. This information shall be kept distinct from the CE-Marking. The number of the standardised assembly is taken from Table 5 of EN 15715:2009. Refer to the manufacturer's literature (ML) for further information;

— declared thermal resistance(R_D) including aging and edge effect according to annex C;

— declared thermal conductivity(λ_D) including aging and edge effect according to annex C;

— nominal thickness (d_N);

— designation code as given in Clause 6;

— working length, according to figure 1;

— working width , according to figure 1;

— number of pieces and area in the package, as appropriate;

— the intended use of the vacuum insulation of buildings is given by the abbreviation ThIB.

NOTE For CE marking and labelling see ZA.3.

EXAMPLE Additional voluntary information:

Any other voluntary information on the product such as:
— Reaction to fire for standardised assembly No. 1, 2, 3, 4

— Voluntary marks

Annex A
(normative)

Determination of the declared values of thermal resistance and thermal conductivity

A.1 General

It is the responsibility of the manufacturer to determine the declared values of thermal resistance and thermal conductivity. He will have to demonstrate conformity of the product to its declared values.
The declared values of thermal resistance and thermal conductivity of a product are the expected values of these properties during an economically reasonable working life under normal conditions, assessed through measured data at reference conditions.

A.2 Input data

The manufacturer shall have at least ten test results for thermal resistance and thermal conductivity, obtained from internal or external direct measurements of VIPs that passed the internal quality control in order to calculate the declared values in accordance with annex C. The direct thermal resistance and thermal conductivity measurements shall be carried out at regular intervals, spread over a time period of the last twelve months. If less than ten test results are available the period may be extended until ten test results are obtained, but with a maximum period of three years, within which the product and production conditions have not changed significantly.
For new products the ten thermal resistance or thermal conductivity test results shall be carried out spread over a minimum period of ten days.
The declared values shall be calculated according to the method given in A.3 and shall be recalculated at a period not exceeding three months of production.

A.3 Declared values

A.3.1 General

The deviation of the declared values, R_D and λ_D, from the calculated values, $R_{90/90}$ and $\lambda_{90/90}$, shall use the rules given in 4.2.1 which include the rounding conditions.

A.3.2 Case where thermal resistance and thermal conductivity are declared

The declared values, R_D and λ_D, shall be derived from the calculated values, $R_{90/90}$ and $\lambda_{90/90}$, which are determined using the equation A.1, A.2 and A.3.

$$\lambda_{90/90} = \lambda_{mean} + k \times s_{\lambda} \quad \text{(A.1)}$$

$$s_{\lambda} = \sqrt{\frac{\sum_{i=1}^{n} (\lambda_i - \lambda_{mean})^2}{n-1}} \quad \text{(A.2)}$$

$$R_{90/90} = d_N / \lambda_{90/90} \quad \text{(A.3)}$$

Values for k shall be taken from Table A.1.

A.3.3 Case where only thermal resistance is declared

The declared value shall be derived from the calculated value which is determined using the equations A.4 and A.5.

$$R_{90/90} = R_{mean} - k \times s_R \quad \text{(A.4)}$$

$$s_R = \sqrt{\frac{\sum_{i=1}^{n} (R_i - R_{mean})^2}{n-1}} \quad \text{(A.5)}$$

Values for k shall be taken from Table A.1.

Table A.1 — Values for k for one sided 90 % tolerance interval with a confidence level of 90 %

Number of test results	k
10	2,07
11	2,01
12	1,97
13	1,93
14	1,90
15	1,87
16	1,84
17	1,82
18	1,80
19	1,78
20	1,77
22	1,74
24	1,71
25	1,70
30	1,66
35	1,62
40	1,60
45	1,58
50	1,56
100	1,47
300	1,39
500	1,36
2000	1,32
For other numbers of test results use Table D.31 of ISO 16269-6:2005, or linear interpolation.	

Annex B
(normative)

Product Type Determination (PTD) and factory production control (FPC)

Table B.1 — Minimum number of tests for PTD and minimum product testing frequencies *(1 of 2)*

Clause		PTD[b]	FPC[a,c]		
		Minimum number of tests[c,d]	Minimum testing frequency		
No	Title		Direct testing	Indirect testing	
				Test method	Frequency
5.1.1.1	Thermal resistance – Thermal conductivity of the VIP	A minimum of 10 tests are needed statistically with a minimum of 4 from the PTD	Initial value 1 per day Value including aging according to annex C 1 per 5 years	–	–
5.1.1.2	Thermal resistance – Thermal conductivity of the core material at ambient pressure	A minimum of 10 tests are needed statistically with a minimum of 4 from the PTD	1 per month	–	–
5.1.2	Inner pressure at least 24 hours after production	4	1 per 24 h	–	–
5.1.4	Thickness	4	1 per 24 h	–	–
5.1.3	Squareness	4	1 per 24 h	–	–
5.1.3	Flatness	4	1 per 24 h	–	–
5.1.5	Reaction to fire of the product as placed on the market	1	1 per year, manufacturers method	–	–
5.2.1	Dimensional stability at specified temperature	4		–	–
5.2.2	Dimensional stability under specified temperature and humidity conditions	4	–	–	–
5.2.3	Deformation under specified compressive load and temperature conditions	4	–	–	–

Table B.2 — Minimum number of tests for PTD and minimum product testing frequencies *(2 of 2)*

Clause		PTD[b]	FPC[a,c]		
		Minimum number of tests[c,d]	Minimum testing frequency		
No	Title		Direct testing	Indirect testing	
				Test method	Frequency
	Compressive stress or strength	4	1 per week or indirect testing	core density	1 per 24 h
5.2.4	Tensile strength perpendicular to faces	4	–	–	–
	Release of dangerous substances	c	c		
	Shear strength	x	xx	xx	xx

a In line with EN 13172, the minimum testing frequencies expressed in test results shall be understood as the minimum for each production unit line under stable conditions. In addition to the testing frequencies given above, testing of relevant properties of the product shall be repeated when changes or modifications are made that are likely to affect the conformity of the product.

b ITT, see EN 13172, and is only relevant when properties are declared.

c Frequencies are not given. When drafting this standard, no European harmonised test method was available.

d Minimum number of tests may be reduced according to EN 13172. For initial type testing of long term thermal, mechanical and freeze-thaw properties test results of similar products produced at different plants or lines will be recognized until testing for a new plant or line is complete.

Table B.3 — Minimum product testing frequencies for the reaction to fire characteristics *(1 of 3)*

Clause		Minimum testing frequency[a]							
No	Title	Direct testing[b]		Indirect testing[c, d]					
	Reaction to fire			Product		Components[e, f]			
						Substantial		Substantial	
4.2.6	class	Test method	Frequency	Test method	Frequency	Test method	Frequency	Test method	Frequency
	A1 without testing[g]	EN 13820	1 per 3 months[h] or 1 per 2 years and indirect testing	–	–	–	–	–	–
				–	–	Loss on ignition	1 per 4 h	Weight per unit area	1 per 1 h
	A1	EN ISO 1182 and EN ISO 1716 (and EN 13823)	1 per 2 years and indirect testing	–	–	Loss on ignition	1 per 4 h	Either loss on ignition or calorific potential	1 per 4 h
						Apparent density	1 per 1 h	weight per unit area	1 per 1 h
	A2	EN ISO 1182 or EN ISO 1716 and EN 13823	1 per 2 years and indirect testing	–	–	Loss on ignition	1 per 4 h	Either loss on ignition or calorific potential	1 per 4 h
						Apparent density	1 per 1 h	Weight per unit area	1 per 1 h
				Manufacturer's method	1 per day	Loss on ignition	1 per 4 h	Either loss on ignition or calorific potential	1 per 4 h
						Apparent density	1 per 1 h	weight per unit area	1 per 1 h

Table B.3 — Minimum product testing frequencies for the reaction to fire characteristics *(2 of 3)*

Clause		Minimum testing frequency[a]							
No	Title	Direct testing[b]		Indirect testing[c, d]					
	Reaction to fire			Product		Components[e, f]			
						Substantial		Non-substantial	
4.2.6	class	Test method	Frequency	Test method	Frequency	Test method	Frequency	Test method	Frequency
	B C D	EN 13823 and EN ISO 11925-2	1 per month or 1 per 2 years and indirect testing	–	–	–	–	–	–
				Manufacturer's method	1 per day	Loss on ignition	1 per 4 h	Either loss on ignition or calorific potential	1 per 4 h
						Apparent density	1 per 1 h	weight per unit area	1 per 1 h
			1 per week or 1 per 2 years and indirect testing	–	–	–	–	–	–
				Manufacturer's method	1 per day	–	–	–	–
	E	EN ISO 11925-2	1 per week or 1 per 2 years and indirect testing	–	–	–	–	–	–
				Manufacturer's method	1 per day	–	–	–	–
	F	–	–	–	–	–	–	–	–
Not all Euroclasses may apply for the products conforming to this standard.									

Table B.3— Minimum product testing frequencies for the reaction to fire characteristics *(3 of 3)*

a	The minimum testing frequencies, expressed in test results, shall be understood as the minimum for a product or a product group for each production unit/line under stable conditions. In addition to the testing frequencies given above, testing of relevant properties of the product shall be repeated when changes or modifications are made that are likely to affect the conformity of the product.
b	Direct testing may be conducted either by third party or by the manufacturer.
c	Indirect testing shall be either on the product or on its components.
d	Indirect testing is only possible in the case of products falling within the system 1 for attestation of conformity of reaction to fire, or by having a notified body verifying the correlation to the direct testing.
e	Definition as given in the Euroclasses Decision, 2000/147/EC: – Substantial component: A material that constitutes a significant part of a non-homogeneous product. A layer with a mass per unit area ≥ 1,0 kg/m^2 or a thickness ≥ 1,0 mm is considered to be a substantial component. – Non-substantial component: A material that does not constitute a significant part of a non-homogeneous product. A layer with a mass per unit area < 1,0 kg/m^2 and a thickness < 1,0 mm is considered to be a non-substantial component.
f	In case of certified components no testing is required.
g	European Decision 96/603EC: Materials to be considered as reaction to fire class A provided for in Decision 94/611/EC without the need for testing (of reaction to fire characteristics).
h	Only for unfaced products.

Annex C
(normative)

Determination of the aged values of thermal resistance and thermal conductivity including edge effect

C.1 General

Ageing procedures shall be used for all VIPs, since the thermal conductivity increases with time via increase of gas pressure, moisture content and possibly changes of the core material's structure itself. These ageing procedures shall represent an characteristic value of 25 years depending on the existing local climate

(→ passed to TC88)
A thermal bridge is created by the differences between the thermal conductivities of the evacuated VIP core and the VIP's envelope material. The linear thermal bridge influence is calculated in accordance to clause C.4.

Kommentar [bs11]:
isn't it the average of the irst 25 years in
European standards EN 13162 to 13171 Thermal insulation products for buildings – Factory made products

and not the characteritic value at 25 years? avarage of the first 25 years might help not to rise the communiccated declaration values.

see
EN 13165:2001 Page 23
..."These methods give a prediction of the 'time averaged' aged value over 25 years."

C.2 Principle

C.2.1. Dry gas characteristic

The increase of thermal conductivity as function of gas pressure can be described by the following formula:

$$\lambda(p) = \lambda_o + \lambda_{air} / (1+p_{1/2} / p) \qquad (C.1.)$$

For $p << p_{1/2}$ the formula simplifies to:

$$\Delta\lambda / \Delta p = \lambda_{air} / p_{1/2} \qquad (C.2.)$$

The increase of thermal conductivity with increasing gas pressure in the VIP can be limited by using getters. The capacity C_1 of the getters, meaning the amount of dry gas that can be absorbed, divided by the yearly permeation of dry gas through the envelope at application temperature, determines the lifetime t_1 of the getter.

$$t_1 = C_1/(p_a * V) \qquad (C.3.)$$

— If no getter is used $t_1 = 0$.

C.2.2. Influence of moisture

The increase of thermal conductivity with increasing moisture content in the VIP can be limited by using desiccants. The capacity C of the desiccants, meaning the mass of water that can be absorbed, divided by the yearly permeation of moisture through the envelope at application temperature, determines the lifetime t_2 of the desiccant.

$$t_2 = C_2/X_{wa} \qquad (C.4.)$$

If no desiccant is used $t_2 = 0$.

C.3 Ageing procedures

One of the aging procedures described in C.3.1 and C.3.2 shall be used for further calculations according to C.5.

No getters or desiccants shall be used for the procedures described in C.3.1, since their effect is taken into account via their capacities in C.3.1.5.

C.3.1 Detailed procedure

C.3.1.1 Determination of pressure dependent increase of thermal conductivity $\lambda_p = \Delta\lambda / \Delta p$

One or several VIPs with different inner pressures shall be produced. The first inner pressure shall be a typical production pressure. The other inner pressures shall be within the next three pressure decades.

Example 1: a silica VIP is typically produced with 3 mbar inner pressure. Thus it is possible to use e.g. the inner pressures 3 mbar, 20 mbar, 350 mbar and 1000 mbar.

Example 2: a fiber VIP is typically produced with 0,01 mbar inner pressure. Thus it is possible to use e.g. the inner pressures 0,01 mbar, 0,2 mbar, 2,5 mbar, 30 mbar.

The thermal conductivity of the VIP with all these inner pressures shall be measured according to 4.2.1.1 and $p_{1/2}$ shall be determined as best fit to equation (C.1). $\lambda_p = \Delta\lambda / \Delta p$ is then calculated via equation (C.2).

C.3.1.2 Determination of humidity dependent increase of thermal conductivity $\lambda_{Xw} = \Delta\lambda / \Delta X_w$

C.3.1.2.1 Possible procedure of raising the humidity content inside the VIP

The envelope film of VIP is cut open, filled with ice and re-welded in a new envelope within a few minutes. The reason for the use of ice instead of water is the lower vaporisation at low pressures during welding process.

Alternatively a thermal conductivity device that can measure under vacuum filled with water vapour to the desired partial pressure can be used.

C.3.1.2.2 Measurement of thermal conductivity

The measurement of thermal conductivity is performed by means of guarded hot plate or heat flow metre method according to 4.2.1.1..
$\Delta\lambda$ is determined by calculating the difference between the thermal conductivity value of VIP at initial state and the thermal conductivity value of VIP after cut open, filled with ice and re-welded in a new envelope. ΔX_w is determined by calculating the difference between humidity content of VIP at initial state (0 mass-%) and humidity content (mass-%) of VIP after cut open, filled with ice and re-welded in a new envelope procedure. The humidity-dependent increase of thermal conductivity is then calculated via the following equation:

$$\lambda_{Xw} = \Delta\lambda / \Delta X_w \quad \text{(C.5.)}$$

C.3.1.3 Measurement of humidity ~~ab~~adsorption, determination of sorption isotherm $X_w(\varphi)$ at constant 23°C

The core material is dried in the oven at 105°C in order to achieve the initial value (0 % relative humidity). Then the core material is placed in a climate chamber first at 35 % anf then at 50 % raltive humidity until constant weight is reached and the increase in weight compared to the initial value is measured. $X_{w,eq}$ is given by the weight increase at 50 % relative humidity.

Formatiert: Hervorheben

Kommentar [bs12]:
just a thought:

shall a test lab "believe", that no desicacant nor (a powdery) getter is added? or shall, the accellerated test condition be so long (so hard), that the lambda at end of test time shall be estimated 25 years averaged aging?
(i.e. FIW test for about 9 month, not 6 month to check the 12.5 years getter capaciity and 18 month for 25 years...
based on the scaling factor of 15.3 in reference [Sprengard2011a] as discussed in
Best3 Paper_Brunner 201204
page24 with citing

[Sprengard2011a] Sprengard Ch., „Analyse vorhandenen Daten zur Alterungsuntersuchungen an VIP, Symposium "Anwendungen der Vakuumdämmung im Bauwesen" 17.3.2011, Berlin

in meantime also in
[14] C. Sprengard, M.H. Spitzner, Investigations into ageing and thermal bridging invacuum insulation panels (VIP) for construction applications, Bauphysik 33 (4)(2011) (German Journal for Building Physics, in German only).)
is the "der Faktor zu 15,3," mentinoned

Kommentar [bs13]:
suggestion to with "(approximated as 0 % relative humidity)" as there as papers in the worldwide pipeline that show, that much hotter drying could be used. (full papers related to IVIS)

Kommentar [bs14]:
typing errors
change " anf then at 50 % raltive humidity"
to "and then at 50 % relative humidity"

Kommentar [bs15]: suggestion to change " $X_{w,eq}$ is given by the weight increase at 50 % relative humidity."
to
" $X_{w,eq}$ is approximated with the weight increase at 50 % relative humidity."
The true value might be higher, as shown best by Bernard Yrieix et al, e.g at IVIS2013.

C.3.1.4 Storage of Vacuum Insulation Panels at 23°C / 50 % relative humidity over a period of six months

Three test specimens (VIP) with a thickness from the lower range of thickness and two different formats are stored at 23°C / 50 % relative humidity over a period of six months. At the start of storage, after three months, and at the completion of storage after six months the thermal conductivity, the internal pressure as well as the weight are measured. From the determined values for internal pressure and weight the annual increase of internal pressure of VIP p_a and the annual increase of weight (= increase in humidity X_{wa}) can be calculated.

From this value and C.3.1.3. the time constant humidity compensation τ = Xw,eq / Xwa , can be calculated.

C.3.1.5 Calculation of long term value of Vacuum Insulation Panels

The calculation of the long-term value of vacuum insulation panels is performed by means of one of the following formulae:

For $t < (t_1, t_2)$: $\lambda_{mean,\ a}(t) = \lambda_{mean,\ initial}$ (C.6)

For $t_1 < t < t_2$: $\lambda_{mean,\ a}(t) = \lambda_{mean,\ initial} + \lambda_p \cdot p_a \cdot (t - t_1)$ (C.7)

For $t_2 < t < t_1$: $\lambda_{mean,\ a}(t) = \lambda_{mean,\ initial} + \lambda_{Xw} \cdot X_{w,eq} \cdot (1 - e^{(-(t-t_2)/\tau)})$ (C.8)

For $t > (t_1, t_2)$:

$\lambda_{mean,\ a}(t) = \lambda_{mean,\ initial} + \lambda_p \cdot p_a \cdot (t - t_1) + \lambda_{Xw} \cdot X_{w,eq} \cdot (1 - e^{(-(t-t_2)/\tau)})$ (C.9)

For further calculations according to clause C.5., the value after 25 years shall be used:

For $25\ a < (t_1, t_2)$: $\lambda_{mean,\ a}(25a) = \lambda_{mean,\ initial}$ (C.10)

For $t_1 < 25a < t_2$: $\lambda_{mean,\ a}(25a) = \lambda_{mean,\ initial} + \lambda_p \cdot p_a \cdot (25\ a - t_1)$ (C.11)

For $t_2 < 25a < t_1$: $\lambda_{mean,\ a}(25a) = \lambda_{mean,\ initial} + \lambda_{Xw} \cdot X_{w,eq} \cdot (1 - e^{(-(25a-t_2)/\tau)})$ (C.12)

For $25\ a > (t_1, t_2)$:

$\lambda_{mean,\ a}(25a) = \lambda_{mean,\ initial} + \lambda_p \cdot p_a \cdot (25a - t_1) + \lambda_{Xw} \cdot X_{w,eq} \cdot (1 - e^{(-(25a-t_2)/\tau)})$ (C.13)

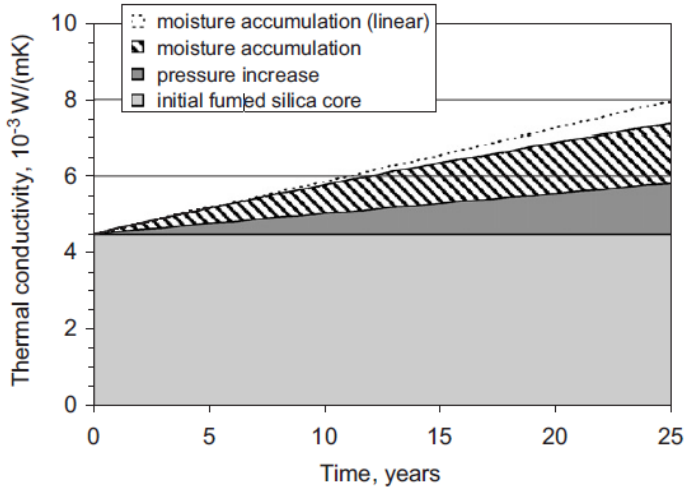


Fig. 12. Effect of pressure increase and moisture accumulation on the thermal conductivity of VIP (format $100 \times 60 \times 2\,cm^3$) over a period of 25 years. The dotted line indicates the increment omitting moisture saturation.

Kommentar [bs16]:
at Empa we use:
Three test specimens (VIP) of each format at least (often 4 or 5), with 500 x 500 mm in three thickness (lower range, 20 mm and thick) and from lower thickness 250 x 250mm nominal format.

Kommentar [bs17]:
At the start of storage,, but at least 1 month after production, 3 month and 6 month later..

Kommentar [bs18]:
Calculation of long term center-of-panel value of Vacuum Insulation Panels

Kommentar [bs19]:
with t1 from eq. C3 on getters
and t2 from eq. C4 on dessicant

Kommentar [bs20]:
aline "For further calculations.."

aline also 4 lines below the "For 25a ... and the equation there.

Kommentar [bs21]:
image is out of
H. Simmler, S. Brunner / Energy and Buildings 37 (2005) 1122–1131

C.3.2 Accelerated ageing procedure

This ageing procedure assumes that the increase in thermal conductivity is only dependent on the increase of air pressure inside the element.

Initial state measurement of thermal conductivity shall be carried out according to EN 12667 and initial state measurement of internal pressure (p_0) according to Annex D.

Next, the individual VIPs shall be stored under the following conditions for the following time periods:
— 8 days at 80°C / -15 °C, the temperature changing each 12 hours;

— 180 days at 80°C.

Finally the thermal conductivity of the final entire assembly shall be measured in accordance with EN 12667. The mean value obtained from these measurements shall be taken as λ_a (25a) for further calculations according to clause C.5.

Additional measurements of thermal conductivity measurements in accordance with EN 12667 can be carried out, e.g. after the 8 days of temperature change and after the first 90 days of storage at 80°C.

Three measurement thicknesses d including the thinnest and thickest offered shall be used for the above accelerated aging procedure.

--> New proposal for clause C.3 will be prepared by Task Group "Aging".

C.4 Determination of linear thermal transmittance of Vacuum insulation panels

→ Mr Sprengard shall be asked whether this can be rewritten more specific
At a temperature difference ΔT above the VIP an additional heat flow develops in the boundary area of the length l due to the enclosing envelope with metallic layers.
The determination of the linear thermal transmittance Ψ can be carried out by measurement or by calculation:

1) Determination by measurement:

   Thereby four VIP of equal size are assembled to one surface (by striking them slightly against each other). The stroke of these VIP is in the measurement centre of the measurement surface (two plates method according to EN 12667 and ISO 8302 respectively). The measurement has to be documented carefully.

2) Determination by calculation: [Kommentar [JD36]:Diagramm required]

   Numerical calculations shall be carried out in accordance with EN ISO 10211.According to the very thin layers of the sealing material (usually aluminium) it is strongly recommended to use Finite Difference Method (FDM) instead of Finite Element Method (FEM). Numerical modelling should take into account even smallest gaps filled with air or sealing material between two panels. The used details and boundary conditions have to be documented carefully.

C.5 Determination of declared thermal conductivity including ageing and thermal bridge effect

C.5.1 General

The aged values of the thermal conductivity, $\lambda_{90/90}$, /thermal resistance, $R_{90/90}$, shall be calculated in accordance with clause 5.1.1, annex A, C.3, and this clause.

Kommentar [PU22]: Mr. Heymans was asked to rewrite this clause

Kommentar [bs23]: 3.2.1 Accelerated aging procedure at mainly dry conditions

Formatiert: Hervorheben

Formatiert: Hervorheben

Formatiert: Schriftart: Fett, Hervorheben

Formatiert: Schriftart: Fett

Formatiert: Schriftart: Fett, Hervorheben

Formatiert: Schriftart: Fett

Kommentar [bs24]: and due to air gaps as well as due to the polymeric laminate TC differnce to the VIP core TC.

Kommentar [bs25]: e.g regarding the gap width within the measuring area as far as visible.

Kommentar [bs26]: mightbe the equation for the linear thermal transmittance Ψ as it was given in BEST3 Paper_Brunner 201204 which is CEN-TC88-WG11_N0005_... in Eq.1

Kommentar [bs27]: The aged values of the thermal conductivity at the center of panel,

The statistical values k, s_λ and s_R as required in annex A shall be calculated using measurements of the initial values of thermal conductivity within 90 days after production.

For the calculation of, $\lambda_{mean,}$ as required according to annex A, aged values determined according to C.3 shall be used, representing $\lambda_{mean,\,a}$ (25 a).

A minimum of 10 values per declared product or product group shall be available every year, based on initial values within 90 days of production.

The linear thermal transmittance Ψ shall be determined according to C.4.

C.5.2 Calculation $\lambda_{90/90}$, $R_{90/90,}$ λ_d and R_d values

$$\lambda_{90/90,\,aged} = \lambda_{mean,a}\ (25\ a) + k \times s_{\lambda I} \quad (C.14)$$

$$R_{90/90,\,aged} = d_N / \lambda_{90/90} \quad (C.15)$$

$$\lambda_D = (\lambda_{90/90,\,aged} + \Psi \cdot d_N \cdot (p/S)) \quad (C.16)$$

$$R_d = d_N / \lambda_D \quad (C.17)$$

The declared value of thermal conductivity, λ_d, defined as limit value including aging of 25 years and the thermal bridge effect of the VIP envelope shall be rounded upwards to the nearest 0,0001 W/(m·K) and declared in levels with steps of 0,0001 W/(m·K).
The declared value of thermal resistance R_d shall be rounded downwards to the nearest 0,05 m²·K/W, and declared in levels with steps of 0,05 m²·K/W.

With P, S: Perimeter, Surface of the VIP.

C.6 Product grouping

The manufacturer shall declare either:

— separate thermal values for each single product and each single thickness and then determine the, $\lambda_{90/90,}$ value on each thickness for each product or

— thermal values for a product or product group including all or a range of thicknesses using the, $\lambda_{90/90,}$ value of the product or product group for the corresponding thickness range.

The manufacturer shall decide whether he will create groups and the size of the groups. Determined thermal values of thin, medium and thick products shall be included in the statistics of a product or product group which covers a complete or a thickness range.

A minimum of 10 aged values shall be determined per product or product group.

Kommentar [bs28]:
instead of " aged values determined according to C.3 " one should use the aging related increase in TC determined according to C.3 " followed by
" shall be used, representing Δλ mean, a (25 a).
--- no better is
Δλmean, 12.5a for the mean increase in thermal conductivity after ageing calculated as average of the first 25 years for the years 12.5
(with a for Annum)

Kommentar [bs29]:
λ 90/90, aged
= λmean + k × sλI +Δλmean, 12.5a

Kommentar [bs30]:
replace "λ 90/90 " by "λ 90/90, aged"

Kommentar [bs31]:
including the averaged aging of the first 25 years

Kommentar [bs32]:
(by using the λD value before it got rounded upwards)

Annex D
(normative)

Measurement of internal pressure

D.1 General

The measurement of internal pressure for VIPs without evacuation valves shall be performed by means of one of the methods described in D.2 or D.3. For VIPs with evacuation valves the methods described in D.4 can be used.

D.2 Pressure compensation method

The external pressure around the VIP is reduced in a vacuum chamber or the external pressure around one part of the VIP is reduced under a suction bell until it falls below the internal pressure of the VIP. Due to the small overpressure inside the VIP the flexible envelope begins to peel off the core material. This procedure is recorded by means of optical distance measurement in combination with the external pressure and leads to the calculation of the compensation pressure (= internal VIP pressure).
In case the measurement shows a result for VIP inner pressure which is below the predetermined maximum pressure the test is passed. Otherwise the test is failed.

D.3 Pressure sensor method

The inner pressure is measured either directly or indirectly by a sensor placed inside the VIP according to one of the methods described in D.3.1 or D.3.2.

D.3.1 Direct Measurement

The measurement described in this section is based on a miniaturized pressure sensor that is integrated into the core material of the VIP [1]. This sensor is operating as a transponder for wireless measurement of the inner pressure of the panel. The activation of the sensor takes place by inductive coupling.
The measurements are taken by a reader unit. The reader unit displays the sensor values and stores them on a memory card.
The measurement accuracy of this method is 0,1 mbar at fixed temperature.
In case the measurement shows a result for VIP inner pressure which is below the predetermined maximum pressure the test is passed. Otherwise the test is failed.

D.4. Method for elements with evacuation valve

For elements with an evacuation valve or an evacuation flange two different methods of measurement are possible to use.
a) Measurement directly following the evacuation process
The inner pressure of the VIP can be taken directly from the display of the evacuation pump.
b) Measurement after completion of the evacuation process / on the building site
The evacuation flange (or valve) of the VIP gets connected to a special flange of the vacuum pump, which is equipped with an – for example optoelectrical – sensor for distance measurement, see sketch in figure D.4-1.
After starting the evacuation process the pressure pVP of the vacuum pump will decrease until it coincides with the inner pressure of the VIP pi. In the moment when the pressure pVP of the vacuum pump starts to fall below the pressure of the VIP pi due to continuing the evacuation process the closure of the flange or valve (in the sketch shown as a ball of stainless steel) will take off and will move towards the senor, which registers the movement as well as the actual pressure pvP with pi = pVP.

Formatiert: Hervorheben

Kommentar [bs33]:
replace "(=internal VIP pressure)" by "(=inner VIP pressure)" to be consistent with the wording in the first part of this draft.

(inner pressure is prefered, as "internal pressure" has another meaning as visible in http://en.wikipedia.org/wiki/Internal_pressure)

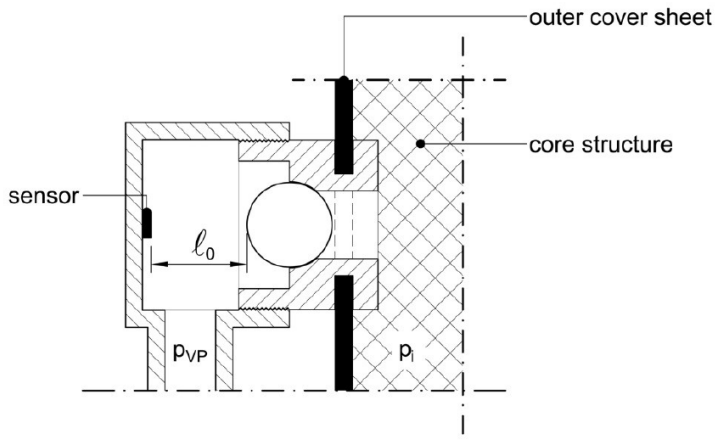


Fig. D.4-1 Sketch regarding the principle assembly of a pressure measurement after completion of the evacuation process / on the building site

--> New proposal for Annex D will be prepared by Task Group "Pressure measurement".

Formatiert: Schriftart: Fett

Annex E
(normative)

Mounting and fixing procedure for reaction to fire tests

E.1 General.

The reaction to fire classifications (Euroclasses) shall be determined in accordance with EN 13501-1.
The classification for the product, as placed on the market, corresponds to a product that has not been incorporated in the structure, therefore without other products such as adhesives, sealants, etc...
This classification is compulsory and shall be included in the marking and labelling. Detailed information about the test conditions and about the field of application of the classification as stated in the reaction to fire classification report shall be given in the manufacturer's literature and in the declaration of performance .

E.2 Instructions for mounting and fixing test specimens.

E.2.1 General

This annex gives instructions for mounting and fixing for reaction to fire testing of VIP, as placed on the market and includes the field of application for the reaction to fire measurements.

E.2.2 Product and installation parameters

Tables E.1 and E.2 give the parameters that have to be taken into account when determining the reaction to fire performance and the field of application of the test results.
The following tables are valid for flat products.

Table E1 – Product parameters

Product parameters	EN ISO 1182 (Class A1 and A2)	EN ISO 1716 (Class A1 and A2)	EN 13823 (Class A1 to D)	EN ISO 11925-2 (Class B to E)
Thickness	–	–	X	X
Density	X	–	X	X
Type of facing	–	X	X	X
Thickness and surface area of the facing	–	X	X	X
Type and amount of adhesive per face	–	X	X	X
Asymmetry	–	–	X	X

Table E2 – Installation parameters

Parameters	EN 13823 (Class A1 to D)	EN ISO 11925-2 (Class B to E)
Exposure to thermal attack	X	X
Substrate	X	--
Space or air layer	X	--
Joints and edges	X	X
Dimensions and position of the test specimen for the test	X	--
Product orientation and geometry	X	X
Fixing of the test specimens	X	--

E.2.3 Mounting and fixing

All the test specimens of the products as required for the specific tests (dimensions and shape) shall be defined by the manufacturer.

E.2.3.1 Ignitability, EN ISO 11925-2 exposure to thermal attack.

The product shall be tested directly exposed to the thermal attack. Both surface and edge shall be exposed to the flame.

E.2.3.1.1 Substrate

The test specimen shall be mounted in the test apparatus without complementary product and without covering.

E.2.3.1.2 Product orientation and geometry

Homogeneous products and products with the same facing on both sides shall be tested on one face only.

If the product faces are not the same or if the product is asymmetrical, two options are provided for declaration:
either the worst test result will be used to declare the reaction to fire class of the product (valid for both faces exposed); or
a declaration of the reaction to fire class of each face is made, provided that the identification of the faces is clearly visible in the marking and labelling of the product.

In case of a Euroclass F declaration for one of the faces, no test needs to be performed on that face.

E.2.3.2 Single burning item (SBI) EN 13823

E.2.3.2.1 Exposure to thermal attack

The product shall be directly exposed to the thermal attack.

E.2.3.2.2 Substrate

The type of substrate is defined in EN 13238.

The general substrate to be used to test the product in accordance with the use on site, is made of calcium silicate.

The test conditions and limit to the applicability of the classification shall be given in the declaration of performance, in the classification report and in the manufacturer's technical literature.

E.2.3.2.3 Air gaps / cavities

The test specimen (the product itself) shall be mounted in the test apparatus without an air gap/ cavity (neither between the product and the substrate nor between the substrate and backing board).

E.2.3.2.4 Joints and edges

The general test is to be carried out with one vertical joint and one horizontal joint in the long wing. Alternatively, the testing can be done either with a horizontal or a vertical joint. Positioning of the joints shall be in accordance with EN 13823 (see Figure 1).

Testing with a vertical and a horizontal joint in the same test reflects a worst case situation and gives the widest field of application.
The test specimens taken from product samples that are small shall be arranged in the test apparatus such that the point required by EN 13823 are in the correct places. Other joints, resulting from the product size, may also be present. All joints (in the corner and at the long wing) shall be installed without a flashing or a sealant and tightly closed.

Products shall be mounted with the edges as existing ; results from testing with butt edges are valid for all types of edges.

If a horizontal or vertical joint is used, the test conditions and field of application of the classification shall be given in the declaration/certification of performance , in the classification report and in the manufacturer's technical literature.

E.2.3.2.5 Size and positioning of the test specimen

The size of the test specimens is given in EN 13823.

Positioning of the test specimens shall meet the following conditions:

the guidelines from paragraph 4 shall be taken into account;
products having smaller dimensions that the SBI test specimen shall be mounted in such way that the installation of full size products is started at the bottom corner line between both wings and joints;
the specimens installed on the small wing shall cover (on their thickness) those installed at the long wing with a butt joint (see Figure 2);
the maximum thickness of the test specimen including the substrate that can be installed in the SBI is 200 mm.

E.2.3.2.6 Product orientation and geometry

Homogeneous products and products having the same facing on both sides, are tested on one face only.

If the product surfaces are not the same or if the product is asymmetrical, two options are open for declaration:
- either the worse test result will be used to declare the reaction to fire class of the product (valid for both faces exposed) ; or
- a declaration of the reaction to fire class of each face is made, provided that the identification of the faces is clearly visible in the marking and labelling of the product.

In case of a Euroclass F declaration for one of the faces, no test needs to be performed on that face.

E.2.3.2.7 Fixing the test specimen

The product is fixed to the substrate with the aid of an adhesive in accordance with the manufacturer's instructions.

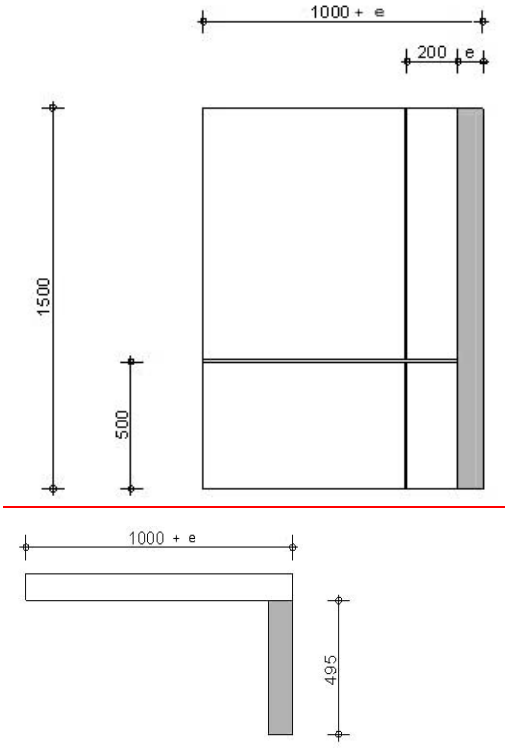
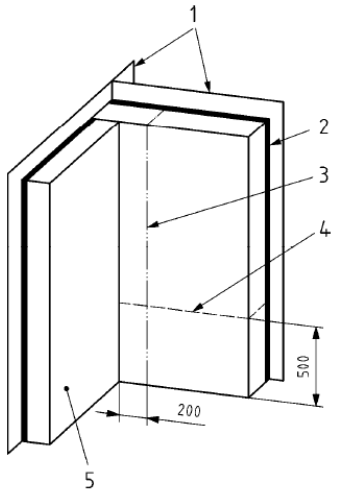


Figure E.1 : Dimensions and positioning of the test specimen

Dimensions in mm



Key:

1 Backing Board
2 Substrate
3 Vertical joint
4 Horizontal joint
5 Product

Figure E.2 - Installation of specimen according to EN 13823

Formatiert: Englisch (Großbritannien)

Annex ZA
(informative)

Formatiert: Englisch (USA)

Clauses of this European Standard addressing the provisions of the EU Construction Products Regulation

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under Mandate M/103[2)] "Thermal insulation products" given to CEN by the European Commission and the European Free Trade Association.
If this European standard is cited in the Official Journal of the European Union (OJEU), the clauses of this standard, shown in this annex, are considered to meet the provisions of the relevant mandate, under the Regulation (EU) No. 305/2011.
This annex deals with the CE marking of the factory made Vacuum insulation intended for the use indicated in Table ZA.1 and shows the relevant clauses applicable.
This annex has the same scope as Clause 1 of this standard related to the aspects covered by the mandate and is defined by Table ZA.1

2) As amended by mandates M126, M130 and M367

Table ZA.1 — Relevant clauses for factory made Vacuum insulation and intended use

Product:	**Factory made** Vacuum insulation VIP **products as covered by the scope of this standard**
Intended use:	**Thermal insulation for buildings**

Essential Characteristics	Clauses in this and other European standard(s) related to essential characteristics	Regulatory classes	Notes
Reaction to fire	Reaction to fire	Euroclasses	
Release of dangerous substances to the indoor environment	Release of dangerous substances	–	
Acoustic absorption index	Sound absorption	–	
Impact noise transmission index *(for floors)*	Dynamic stiffness	–	
	Thickness, d_L	–	
	Compressibility, c	–	
	Air flow resistivity	–	
Direct airborne sound insulation index	Air flow resistivity	–	
Continuous glowing combustion	Continuous glowing combustion	–	
Thermal resistance	Thermal resistance and thermal conductivity	–	
	Thickness	–	
Water permeability	or Short term water absorption Long term water absorption	–	
Water vapour permeability	Water vapour transmission	–	
Compressive strength	Compressive stress or compressive strength	–	
	Point load	–	
Durability of reaction to fire against heat, weathering, ageing/degradation	Durability characteristics [a]	–	
Durability of thermal resistance against heat, weathering, ageing/degradation	Thermal resistance and thermal conductivity	–	
	Durability characteristics	–	
Tensile/Flexural strength	Tensile strength perpendicular to faces[e]	–	
Durability of compressive strength against ageing/degradation	Compressive creep	–	

[a] No change in reaction to fire properties for VIP products.

[b] The fire performance of VIP does not deteriorate with time. The Euroclass classification of the product is related to the organic content, which cannot increase with time.

[c] Thermal conductivity of VIP products does not change with time, experience has shown the fibre structure to be stable and the porosity contains no other gases than atmospheric air.

[d] For dimensional stability thickness only.

[e] This characteristic also covers handling and installation.

The declaration of the product performance related to certain essential characteristics is not required in those Member States (MS) where there are no regulatory requirements on these essential characteristics for the intended use of the product. In this case, manufacturers placing their products on the market of these MS are not obliged to determine nor declare the performance of their products with regard to these essential characteristics and the option “No performance determined” (NPD) in the information accompanying the CE marking and in the declaration of performance (see ZA.3) may be used for those essential characteristics.

ZA.2 Procedures for (AVCP) of factory made Vacuum insulation products

ZA.2.1 Systems of AVCP

The AVCP systems of factory made Vacuum insulation products indicated in Table ZA.1, established by EC Decision 95/204/EC of 31.04.95 revised by decision 99/91/EC of 25.01.99 amended by the decision 01/596/EC of 8th January is shown in Table ZA.2 for the indicated intended use and relevant level(s) or class(es) of performance.

Table ZA.2 — Systems of AVCP

Product(s)	Intended use(s)	Level(s) or class(es) (reaction to fire)	AVCP system(s)
Thermal insulation products (Factory made products)	For uses subject to regulations on reaction to fire	(A1, A2, B, C)[a]	1
		(A1, A2, B, C)[b], D, E	3
		(A1 to E)[c], F	3 (with 4 for RTF)
	Any	—	3
System 1: See Regulation (EU) No. 305/2011 (CPR) Annex V, 1.2 System 3: See Regulation (EU) No. 305/2011 (CPR) Annex V, 1.4 System 4: See Regulation (EU) No. 305/2011 (CPR) Annex V, 1.5			

[a] Products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material).

[b] Products/materials not covered by footnote ([a]).

[c] Products/materials that do not require to be tested for reaction to fire (e.g. products/materials of classes A1 according to Commission Decision 96/603/EC, as amended).

The AVCP of the factory made Vacuum insulation products in Table ZA.1 shall be according to the AVCP procedures indicated in Tables ZA.3.1 to ZA.3.3 resulting from application of the clauses of this or other European Standard indicated therein. The content of tasks of the notified body shall be limited to those essential characteristics as provided for, if any, in Annex III of the relevant mandate and to those that the manufacturer intends to declare.

Table ZA.3.1 — Assignment of AVCP tasks for factory made Vacuum insulation products under system 1 for reaction to fire and system 3 (see Table ZA.2) *(1 of 2)*

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.	
	Further testing of samples taken at factory according to the prescribed test plan	Essential characteristics of Table ZA.1 relevant for the intended use which are declared	
	Determination of the product-type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	Essential characteristics of Table ZA.1 relevant for the intended use which are declared and not tested by the notified testing laboratory and by the product certification body involved with reaction to fire	
Tasks for notified testing laboratory	Determination of the product-type on the basis of type testing (including sampling carried out by the manufacturer), type calculation, tabulated values or descriptive documentation of the product	— Thermal resistance; — Release of dangerous substances[a]; — Compressive strength ((for load bearing applications); — Water permeability *(if relevant)*.	
Tasks for the notified product certification body	Determination of the product-type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product [b]	— Reaction to fire	
	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.	

Table ZA.3.1 — Assignment of AVCP tasks for factory made Vacuum insulation products under system 1 for reaction to fire and system 3 (see Table ZA.2) *(2 of 2)*

Tasks		Content of the task	AVCP clauses to apply
	Continuous 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 the FPC.	

[a] No test method available yet.

[b] Sampling shall be carried out as defined in 5.1

Table ZA.3.2 — Assignment of AVCP tasks for factory made Vacuum insulation products under system 3 (see Table ZA.2)

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	
	Determination of the product-type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	Essential characteristics of Table ZA.1 relevant for the intended use which are declared and not tested by the notified testing laboratory	
Tasks for a notified testing laboratory	Determination of the product type on the basis of type testing (based on sampling carried out by the manufacturer) or tabulated values	— Reaction to fire; — Thermal resistance; — Release of dangerous substances[a]; — Compressive strength (for load bearing applications); — Water permeability (if relevant).	

[a] No test method available yet.

Table ZA.3.3 — Assignment of AVCP tasks for factory made Vacuum insulation products under combined system 4 for reaction to fire and system 3 (see Table ZA.2)

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 is declared	
	Determination of the product-type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	Essential characteristics of Table ZA.1 relevant for the intended use which are declared and not tested by the notified testing laboratory	
Tasks for a notified testing laboratory	Determination of the product type on the basis of type testing (based on sampling carried out by the manufacturer) or tabulated values	— Thermal resistance; — Release of dangerous substances[a]; — Compressive strength (for load bearing applications); — Water permeability (if relevant).	

[a] No test method available yet.

ZA.2.2 Declaration of Performance (DoP)

ZA.2.2.1 General

The manufacturer draws up the DoP and affixes the CE marking on the basis of the different AVCP systems set out in Annex V of the Regulation (EU) No 305/2011:

In case of products under system 1

— the factory production control and further testing of samples taken at the factory according to the prescribed test plan, carried out by the manufacturer; and

— the certificate of constancy of performance issued by the notified product certification body on the basis of determination of the product type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product; initial inspection of the manufacturing plant and of factory production control and continuous surveillance, assessment and evaluation of factory production control.

In case of products under system 3

— the factory production control carried out by the manufacturer; and

— the determination of the product-type on the basis of type testing (based on sampling carried out by the manufacturer), type calculation, tabulated values or descriptive documentation of the carried out by the notified testing laboratory.

In case of products under system 4

— the factory production control carried out by the manufacturer

— the determination by the manufacturer of the product-type on the basis of type testing, type calculation, tabulated values or descriptive documentation of the product.

ZA.2.2.2 Content

The model of the DoP is provided in Annex III of the Regulation (EU) No 305/2011.

According to this Regulation, the DoP shall contain, in particular, the following information:

— the reference of the product-type for which the declaration of performance has been drawn up;

— the AVCP system or systems of the construction product, as set out in Annex V of the CPR;

— the reference number and date of issue of the harmonised standard which has been used for the assessment of each essential characteristic;

— where applicable, the reference number of the Specific Technical Documentation used and the requirements with which the manufacturer claims the product complies.

The DoP shall in addition contain:

a) the intended use or uses for the construction product, in accordance with the applicable harmonised technical specification;

b) the list of essential characteristics, as determined in the harmonised technical specification for the declared intended use or uses;

c) the performance of at least one of the essential characteristics of the construction product, relevant for the declared intended use or uses;

d) where applicable, the performance of the construction product, by levels or classes, or in a description, if necessary based on a calculation in relation to its essential characteristics determined in accordance with the Commission determination regarding those essential characteristics for which the manufacturer shall declare the performance of the product when it is placed on the market or the Commission determination regarding threshold levels for the performance in relation to the essential characteristics to be declared;

e) the performance of those essential characteristics of the construction product which are related to the intended use or uses, taking into consideration the provisions in relation to the intended use or uses where the manufacturer intends the product to be made available on the market;

f) for the listed essential characteristics for which no performance is declared, the letters "NPD" (No Performance Determined).

Regarding the supply of the DoP, article 7 of the Regulation (EU) No 305/2011 applies.
The information referred to in Article 31 or, as the case may be, in Article 33 of Regulation (EC) No 1907/2006, (REACH) shall be provided together with the DOP.

ZA.2.2.3 Example of DoP

The following gives an example of a filled-in DoP for factory made Vacuum insulation for EN ISO XXX

DECLARATION OF PERFORMANCE
No 0123-CPR- 2013/10/07

1. Unique identification code of the product-type: **ABCD**
2 Type, batch or serial number or any other element allowing identification of the construction product as required under Article 11(4) of the CPR: **see product label**
3. Intended use or uses of the construction product, in accordance with the applicable harmonised technical specification, as foreseen by the manufacturer: **Thermal insulation for buildings**
4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required under Article 11(5): **Any Co Ltd, PO Box 21, B-1050**
5. Where applicable, name and contact address of the authorised representative whose mandate covers the tasks specified in Article 12(2): **not relevant**
6. System or systems of assessment and verification of constancy of performance of the construction product as set out in CPR, Annex V: **Systems 1 and 3**
7. In case of the declaration of performance concerning a construction product covered by a harmonised standard: **Notified certification body No. 4567 performed, carried out the determination of the product type, the initial inspection of the manufacturing plant and of factory production control and the continuous surveillance, assessment and evaluation of factory production control and issued the certificate of constancy of performance for reaction to fire. Notified testing laboratory No. 7456 performed the test reports for the other relevant declared characteristics**
8. Declared performance

Essential characteristics	Performance	Harmonised technical specification
Reaction to fire	Reaction to fire	EN ISO XX :2013
Thermal resistance	Thermal resistance and R_D $m^2 \cdot K/W$ thermal conductivity λ_D W/m·K thickness d_N 100 mm, T3	
Nominal Thickness	Nominal Thickness mm Thickness Tolerance	
Compressive strength	Compressive stress	
Water vapour permeability	Water vapour transmission, Water vapour diffusion resistance factor,	

Kommentar [bs34]: reformate the line spacing

9. The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 8. This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4. Signed for and on behalf of the manufacturer by:

…….
……
(Name and function)

……..……
…….....
(Place and date of issue) (Signature)

NOTE For characteristics where e.g. the declaration is different for different thickness a Table is needed instead of a single value in the Table above

ZA.3 CE Marking and labelling

The CE marking symbol shall be in accordance with the general principles set out in Article 30 of Regulation (EC) No 765/2008 and shall be affixed visibly, legibly and indelibly:

— to the factory made Vacuum insulation product (VIP) or

— to a label attached to it.

Where this is not possible or not warranted on account of the nature of the product, it shall be affixed to the packaging or to the accompanying documents.

The CE marking shall be followed by:

— the last two digits of the year in which it was first affixed;

— the name and the registered address of the manufacturer, or the identifying mark allowing identification of the name and address of the manufacturer easily and without any ambiguity;

— the unique identification code of the product-type;

— the reference number of the declaration of performance;

— the level or class of the performance declared*;*

— the dated reference to the harmonised technical specification applied;

— the identification number of the notified body *[only for products under systems 1and 3]*;

— the intended use as laid down in the harmonised technical specification applied.

The CE marking shall be affixed before the construction product is placed on the market. It may be followed by a pictogram or any other mark notably indicating a special risk or use.
Figure ZA.1 gives an example of the information related to products subject to AVCP systems 1 and 3 to be given on the product or to a label attached to it

CE 4567 7456	*CE marking, consisting of the "CE"-symbol* *Identification number of the product certification body* *Identification number of the notified test laboratory*
AnyCo Ltd, PO Box 21, B-1050 **13** 0123-CPR-2013/10/07	*name and the registered address of the manufacturer, or identifying mark* *Last two digits of the year in which the marking was first affixed* *reference number of the DoP*
EN ISO XXX:2013 ABCD ThIB RtF E R_D 2.80 m^2·K/W λ_D 0.0071 W/m·K d_N 20 mm *lw* 1000 mm *bw* 600 mm VIP — EN ISO xxx — CS(10\Y)150 — TR970 [Kommentar: [JD38]: Consider new CPR and label to reflect sample designation code]	*No. of European standard applied, as referenced in OJEU* *Unique identification code of the product-type* *Intended use of the product as laid down in the European standard applied* *Reaction to fire – Euroclass* *Declared thermal resistance* *Declared thermal conductivity* *Nominal Thickness* *Working Length* *working Width* *Designation code (in accordance with Clause 6 of this standard for the relevant characteristics according to Table ZA.1)* *Level or class of the performance declared*

Figure ZA.1 — Example CE marking information of products under AVCP system 1 *and system 3*

Formatiert: Nicht Hervorheben
Formatiert: Nicht Hervorheben
Formatiert: Nicht Hervorheben
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Formatiert: Nicht Hervorheben
Formatiert: Nicht Hervorheben
Formatiert: Nicht Hervorheben
Formatiert: Nicht Hervorheben

Bibliography

[1] Bögel, G. vom; Trieu, H.-K.; Görtz, M.; Grabmaier, A. - Wireless integrated pressure sensor for quality control of vacuum insulation panel, Vacuum insulation panels: Advances in applications. 10th International Vacuum Insulation Symposium, IVIS 2011. Proceedings: September 15-16, 2011, Ottawa, Canada page 22-26

Kommentar [bs35]:
[2] H. Simmler, S. Brunner / Energy and Buildings 37 (2005) 1122–1131

as source of the figure in C.3.1.5 Calculation of long term value of Vacuum Insulation Panels

(This Figure has not yet a number - there are still many changes before this position.)

Kommentar [bs36]:
is more literature fitting?

CEN-TC88-WG11_N0005 contains (optimised text for the work in this ISO/CEN WG on VIP) :
[BEST3 paper 2014002] S. Brunner, T. Stahl, K. Ghazi Wakili, Single and double layered vacuum insulation panels of the same thickness in comparison, Building Enclosure Science & Technology Conference (BEST3), April 2-4th 2012, Atlanta

[Brunner2008a] Brunner S. and Simmler H.2008, In situ performance assessment of vacuum insulation panels in a flat roof construction, Vacuum 82, 700–707
(checking the pressure increase in a real application)

[Brunner2014] Brunner S, Ghazi Wakili K, Hints for an additional aging factor regarding the thermal performance of vacuum insulation panels with pyrogenic silica core, Vacuum, 2014:100:4–6 http://dx.doi.org/10.1016/j.vacuum.2013.07.033
(checking the thermal cunductivity after 8 and 8.8 years in real, but exceptional humid application.)

[Schwab2005] Schwab H, Heinemann U, Beck A, Ebert H-P, and Fricke J, Dependence of Thermal Conductivity on Water Content in Vacuum Insulation Panels with Fumed Silica Kernels, Journal of Thermal Envelope and Building Science 2005;28 319-326
(paper about the influence of moisture on TC as linear function)

Ch. Sprengard, M.H. Spitzner, Untersuchungen zu Alterung und Wärmebrücken bei Vakuum-Isolations-Paneelen (VIP) für Bauanwendungen, Bauphysik, 33 (4) 234-242,2011

[GhaziWakili2004] Ghazi Wakili K., Bundi R., Binder B. 2004 Effective thermal conductivity of vacuum insulation panels, Building Research and Information 32, 293–299
(likely the first one on how to measure edge effects of VIPs)

further
CEN-TC88-WG11_N0005 contains

...