© ISO 2022 - All rights reserved

2022-08-24

ISO/FDIS-16478:2022(E)

ISO/TC 163/SC 03

Secretariat:-SCC

Date: 2023-07-11

Thermal insulation products — Vacuum insulation panels (VIPs)—— Specification

iTeh STANDARD PREV

standards.iteh.ai

FDIS stage

https://standards.iteh.ai/catalog/standards/sist/ae000f5d-d648-447

Edited DIS - MUST BE USED FOR FINAL DRAFT

Formatted	(
Formatted	<u></u>
Style Definition	<u></u>
Style Definition	
Style Definition	
Style Definition	
Style Definition	<u></u>
Style Definition	<u></u>
Style Definition	<u> </u>
Style Definition	<u> </u>
Style Definition	<u></u>
Style Definition	<u></u>
<u> </u>	<u></u>
Style Definition	<u></u>
Style Definition	<u> </u>
Style Definition	<u> </u>
Style Definition	<u> </u>
Style Definition	[]
Style Definition	
Style Definition	
Style Definition	<u></u>
Style Definition	
Style Definition	(
Style Definition	(
Style Definition	
Style Definition	(
Style Definition	(
Style Definition Style Definition	
	$\overline{}$
Style Definition	
Style Definition Style Definition	
Style Definition Style Definition Style Definition	
Style Definition Style Definition Style Definition Style Definition	
Style Definition Style Definition Style Definition Style Definition Style Definition	
Style Definition Style Definition Style Definition Style Definition Style Definition Style Definition	
Style Definition	
Style Definition	
Style Definition	
Style Definition	
Style Definition	
Style Definition	
Style Definition	
Style Definition	
Style Definition	
Style Definition	
Style Definition Style Definition	

Style Definition
Style Definition
Style Definition

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font: Bold, English (United Kingdom)

© ISO 2022, Published in Switzerland 2023

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no Part part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO-at the address below or ISO's member body in the country of the requester.

ISO-copyright office <u>CP 401 •</u> Ch. de Blandonnet 8 • <u>CP 401</u> CH-1214 Vernier, Geneva, Switzerland <u>Tel.Phone:</u> + 41 22 749 01 11

Fax + 41 22 749 09 47 copyright@iso.org www.iso.org

E-mail: copyright@iso.org Website: www.iso.org

Published in Switzerland

Formatted: Not Raised by / Lowered by

Formatted: Left: 1.9 cm, Right: 1.9 cm, Bottom: 1 cm, Gutter: 0 cm, Section start: New page, Width: 21 cm, Height: 29.7 cm, Header distance from edge: 1.27 cm, Footer distance from edge: 0.5 cm

Formatted: Default Paragraph Font

Formatted: Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO 16478

https://standards.iteh.ai/catalog/standards/sist/ae000f5d-d648-442f-a<mark>56b-d178ea8c8362/iso-16478</mark>

 $\textbf{Formatted:} \ \mathsf{Footer,} \ \mathsf{Line} \ \mathsf{spacing:} \ \mathsf{single}$

ii

© ISO 2022 All rights reserved

© ISO 2023 - All rights reserved

ISO/DISFDIS 16478:20222023(E)

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font: Bold, English (United Kingdom)

Formatted: Left

Formatted: Normal, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

© ISO 2022 All rights reserved

© ISO 2023 - All rights reserved

Formatted: Footer, Line spacing: single

Edited DIS - MUST BE USED FOR FINAL DRAFT

Formatted: Font: Bold, English (United Kingdom)

Formatted: Font: Bold, English (United Kingdom)

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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives Directives, Part 2Part 2 (see www.iso.org/directives). www.iso.org/directives).

Attention is drawn ISO draws attention to the possibility that some of the elements implementation of this document may be involve the subjectuse of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights- in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html. www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 163, *Thermal performance and energy use in the built environment*, Subcommittee SC 3, *Thermal insulation products, components and systems*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Formatted: English (United Kingdom)

Field Code Changed

Formatted: Footer, Line spacing: single

iv

© ISO 2022 – All rights reserved

© ISO 2023 - All rights reserved

Thermal insulation products —__Vacuum insulation panels (VIPs)-_— Specification

1 Scope

This document-:

- ___defines requirements for vacuum insulation panels (VIPs), with silica or glass fibre core, which are used for thermal insulation of buildings. This document;
- —outlines required product properties, their performance, test methods and rules for conformity evaluations, identification and labelling. The document:
- provides a test method to determine ageing factors and the influence of the linear thermal bridges at the edges.

This document is applicable to all types of silica and glass fibre core VIPs, independent of the type df envelope. In the case of a glass fibre core VIP, it is only applicable to VIPs with desiccants whose service life is ≥ 25 years.

This document does not address any specific installation and application requirements is not applicable to:

- This document does not cover any specific installation and application requirements;
- ___products intended to be used for the insulation of building equipment and industrial installations.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1182, Reaction to fire tests for products — Non-combustibility test

ISO 1716, Reaction to fire tests for products — Determination of the gross heat of combustion (calorificalue)

ISO-3529-1, Vacuum technology — Vocabulary — Part 1: General terms

 ${\tt ISO_3529-2,} \underline{\textit{Vacuum technology} - \textit{Vocabulary} - \textit{Part 2: Vacuum pumps and related terms}$

ISO-3529-3, Vacuum technology — Vocabulary — Part 3: Total and partial pressure vacuum gauges

JSO 8301, Thermal insulation — Determination of steady-state thermal resistance and related properties — Heat flow meter apparatus

ISO 8302, Thermal insulation — Determination of steady-state thermal resistance and related properties — Guarded hot plate apparatus Formatted: Font: Not Bold

Formatted: Header, Space After: 0 pt, Line spacing: single

Formatted: Left: 1.9 cm, Right: 1.9 cm, Bottom: 1 cm, Gutter: 0 cm, Section start: New page, Width: 21 cm, Height: 29.7 cm, Header distance from edge: 1.27 cm, Footer distance from edge: 0.5 cm

Formatted: Main Title 1, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted: List Continue 1, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted: List Continue 1, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted: Default Paragraph Font

Formatted: Default Paragraph Font

Formatted: Default Paragraph Font, Font: Italic

Formatted: Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm + 7 cm

Formatted: Default Paragraph Font

Formatted: Default Paragraph Font

Formatted: Default Paragraph Font, Font: Italic

Formatted: Default Paragraph Font

Formatted: Font: Italic

Formatted: Font: Italic

Formatted: Font: Italic

Formatted: Default Paragraph Font

Formatted: Default Paragraph Font

Formatted: Default Paragraph Font, Font: Italic

Formatted: Default Paragraph Font

Formatted: Default Paragraph Font

Formatted: Default Paragraph Font, Font: Italic

	//	Formatted	
<u>ISO/FDIS 16478:2023(E)</u>	/ //	Formatted	
		Formatted	
ISO 8990, Thermal insulation — Determination of steady-state thermal transmission properties —	$\mathbb{V}_{/}$	Formatted	
Calibrated and guarded hot box		Formatted	
JSO 10211, Thermal bridges in building construction — Heat flows and surface temperatures — Detailed		Formatted	
calculations	/	Formatted	
ISO 10456, Building materials and products — Hygrothermal properties — Tabulated design values and	//	Formatted	
procedures for determining declared and design thermal values		Formatted	
ISO 11025 2 Pagation to five toots. Lanitability of products subjected to direct impire amount of flame		Formatted	
ISO-11925-2, Reaction to fire tests — Ignitability of products subjected to direct impingement of flame — Part 2: Single-flame source test,	\leq	Formatted	
	//	Formatted	
ISO 12136, Reaction to fire tests — Measurement of material properties using a fire propagation apparatus	/	Formatted	
ISO 12567—1, Thermal performance of windows and doors — Determination of thermal transmittance by		Formatted	
the hot-box method — Part 1: Complete windows and doors	V/	Formatted	
ISO 12576-1:2001, Thermal insulation — Insulating materials and products for buildings — Conformity	///	Formatted	
<u>control systems — Part 1: Factory-made products</u>		Formatted	
ISO 29465, Thermal insulating products for building applications—— Determination of length and width	\	Formatted Formatted	
	1	Formatted	
ISO 29466, Thermal insulating products for building applications—— Determination of thickness		Formatted	
ISO 29467, Thermal insulating products for building applications — Determination of squareness	M/N	Formatted	
ISO 29468, Thermal insulating products for building applications—Determination of flatness	////	Formatted	(
ISO 29472, Thermal insulating products for building applications — Determination of dimensional stability		Formatted	
under specified temperature and humidity conditions SO 64/8		Formatted	
EN 13501-1, Fire classification (Euroclasses) of construction products and building elements -		Formatted	
Classification using test data from reaction to fire tests.	//////	Formatted	
EN 12022 Parties to Control Co	\\\\\	Formatted	
EN-13823, Reaction to fire tests for building products - Building products excluding floorings exposed to the thermal attack by a single burning item.	 	Formatted	
	$\langle $	Formatted	
3 Terms, definitions, symbols and units	$\ \ \ \ $	Formatted	
For the purposes of this document, the following terms and definitions apply.	(Formatted	
ISO and IEC maintain terminology databases for use in standardization at the following addresses:	111111	Formatted	
— —ISO Online browsing platform: available at https://www.iso.org/obp		Formatted	[]
		Formatted	
 — IEC Electropedia: available at https://www.electropedia.org/ 	\ \\\\	Formatted Formatted	
3.1 Terms and definitions	1 111	Formatted	
3.1.1	\	Formatted	
vacuum insulation panel	1 / //	Formatted	
VIP	111	1 officeu	

Formatted

2

© ISO 2022 All rights reserved

Formatted

Formatted Formatted

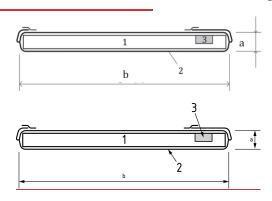
Formatted

insulation element containing open porous *core material* $\frac{(3.1.4)(3.1.4)}{(3.1.4)}$ and an *adsorbent* $\frac{(3.1.8)(3.1.8)}{(3.1.5)}$, where the *inner pressure* $\frac{(3.1.10)(3.1.10)}{(3.1.10)}$ inside the envelope is significantly lower, close to the vacuum (i.e. zero pressure), than the ambient air pressure

Formatted: Font: Bold

Note-1-to-entry:-A schematic view of a VIP is shown in Figure 1. Figure 1.

Dimensions in millimetre



Key

- 1 core material
- 2 envelope
- 3 adsorbent
- ^a Thickness, d (3.1.17).(3.1.17).
- Working length, l₁.

Figure 1 — Schematic view of VIP

3.1.2

silica core VIP

vacuum insulation panel (VIP) $\frac{(3.1.1)(3.1.1)}{(3.1.1)}$ using fumed silica or other comparable silica powders as cormaterial $\frac{(3.1.4)(3.1.4)}{(3.1.4)}$

3.1.3

glass fibre core VIP

vacuum insulation panel (VIP) (3.1.1)–(3.1.1) using glass fibre as core material (3.1.4)–(3.1.4), and generally containing an adsorbent (3.1.9)(3.1.8)

3 1 4

core material

open porous insulation material constituting the main component inside the *vacuum insulation panel* (VIP) (3.1.1) envelope (3.1.5)(3.1.1) envelope (3.1.5)

3.1.5

envelope

barrier layer(s) of the *vacuum insulation panel (VIP)* $\frac{(3.1.1)(3.1.1)}{(3.1.1)}$ resisting gas or vapour permeation into and securing the vacuum inside the VIP

3.1.6

metallized film

MF

laminated film containing a high barrier performance metallic thin layer produced by chemical/physical deposition

© ISO 2022 – All rights reserved

© ISO 2023 - All rights reserved

between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at $0.7\,\mathrm{cm}+1.4\,\mathrm{cm}+2.1\,\mathrm{cm}+2.8\,\mathrm{cm}+3.5\,\mathrm{cm}+4.2\,\mathrm{cm}+4.9\,\mathrm{cm}+5.6\,\mathrm{cm}+6.3\,\mathrm{cm}+7\,\mathrm{cm}$

Formatted: Line spacing: At least 11 pt, Adjust space

Formatted: Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 4.2 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm + 7 cm

Formatted Table

Formatted: Justified, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm + 7 cm

Formatted: Justified, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm + 7 cm

Formatted: Not Superscript/ Subscript

Formatted: Justified, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm + 7 cm

Formatted: Not Superscript/ Subscript

Formatted: Justified, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm + 7 cm

Formatted: None, Space Before: 12 pt, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted: Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted: Font: Bold

3.1.7

aluminium foil laminated film

laminated film containing aluminium foil as a gas barrier layer

3.1.8

adsorbent

material adsorbing either water vapour or dry air, or both, physically or chemically

desiccant

material added inside the *envelope* (3.1.5)(3.1.5) for the purpose of adsorbing water vapour

EXAMPLE

3.1.10

inner pressure

total gas pressure within the vacuum insulation panel (VIP) (3.1.1)(3.1.1)

working length

longer linear dimension of the major surface of the test specimen

Note-1-to-entry:-See Figure 2. Figure 2.

3.1.12

working width

 $w_{\rm w}$

shorter linear dimension of the major surface of the test specimen, measured at right angles to the working length (3.1.11)(3.1.11) s.iteh.ai/catalog/standards/sist/ae000f5d-d648-442

Note_1-_to-_entry:-_See Figure 2.Figure 2.

3.1.13

core length

longer linear dimension of the *core material* (3.1.4)(3.1.4) of the test specimen

Note_1_to_entry:_See Figure 2.Figure 2.

3.1.14

core width

shorter linear dimension of the *core material* (3.1.4) of the test specimen, measured at right angles to the *core length* (3.1.13)(3.1.13)

3.1.15

length of edge seal

longer linear dimension of the edge seal of the test specimen

Note-1-to-entry:-See Figure 2. Figure 2.

© ISO 2022 - All rights reserved

© ISO 2023 - All rights reserved

Formatted: Line spacing: At least 11 pt, Adjust space between Latin and Asian text. Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm +

Formatted: Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted: Line spacing: At least 11 pt, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm +

Formatted: Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

Formatted: Line spacing: At least 11 pt, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm + 7 cm

Formatted: Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

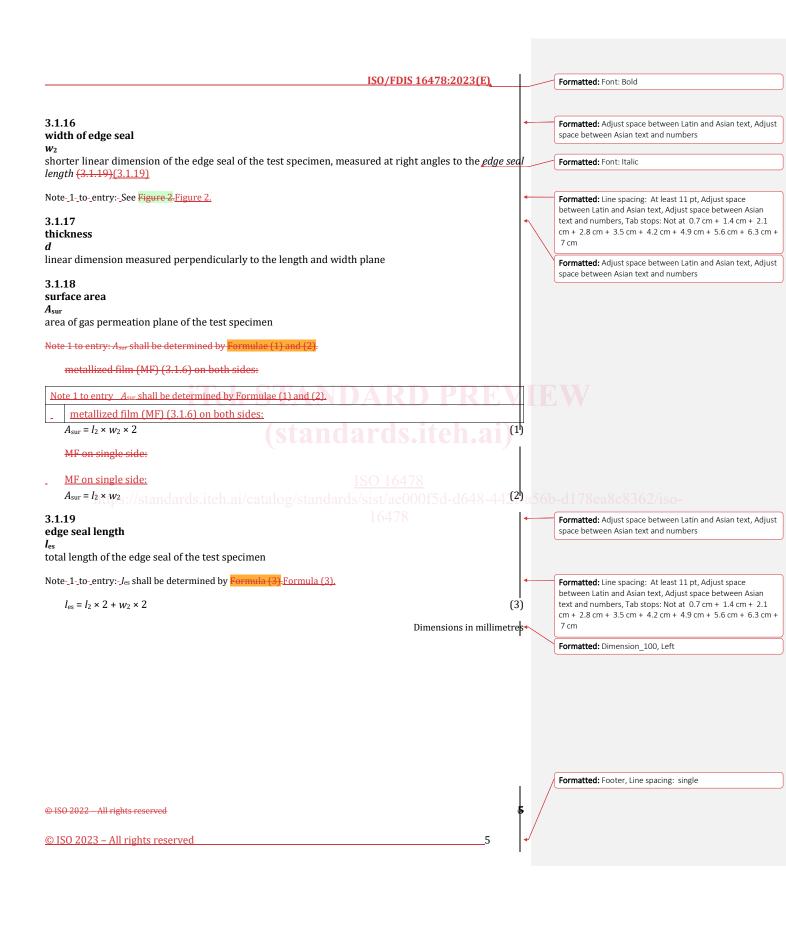
Formatted: Font: Italic

Formatted: Line spacing: At least 11 pt, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm + 7 cm

Formatted: Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

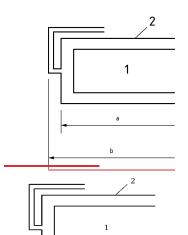
Formatted: Font: Italic

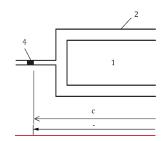
Formatted: Line spacing: At least 11 pt, Adjust space between Latin and Asian text. Adjust space between Asian text and numbers. Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm +





Formatted: Font: Bold





e) VIP: edge seal (4), length of edge seal (4)

Formatted Table

Formatted: Table body (+), Centered, No bullets or numbering, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm + 7 cm

c) VIP: core (1), envelope (2), core length (*), working length (h) a)

ISO 16478

https://standards.iteh.ai/catalog/standards/sist/ae000f5d-d648-442f-at

Formatted: Table body (+), Centered, No bullets or numbering, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm + 7 cm

Formatted: Footer, Line spacing: single

6

© ISO 2022 – All rights reserved

© ISO 2023 – All rights reserved

(standards.iteh.ai)

https://standards.iteh.ai/catalog/standards/sist/ae000f5d-d648-442
16478

<u>d)</u>

f) VIP: adsorbent or desiccant (3), working width (*) d) VIP: width of edge seal (*)

Key

- 1 core material (3.1.4)(3.1.4)
- 2 envelope (3.1.5)(3.1.5)
- 3 adsorbent-or desiccant
- 4 edge seal
- ^a Core length, l_c,(3.1.13),(3.1.13).
- Working length, $l_{w_i}(3.1.11),(3.1.11)$.
- Length of edge seal, l_{es_7} (3.1.15),(3.1.15).

c)

- Working width, w_w , $\frac{(3.1.12)}{(3.1.12)}$.
- Width of edge seal, wes, (3.1.16)(3.1.16)

Figure 2 - Dimensions of a VIP

© ISO 2022 All rights reserved

© ISO 2023 - All rights reserved

Inserted Cells

Formatted: Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm + 7 cm

Formatted: Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm + 7 cm

Formatted Table

Formatted: Justified, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm + 7 cm

Formatted: Justified, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm + 7 cm

Formatted: Justified, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm + 7 cm

Formatted: Not Superscript/ Subscript

Formatted: Justified, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm + 7 cm

Formatted: Not Superscript/ Subscript

Formatted: Justified, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm + 7 cm

Formatted: Not Superscript/ Subscript

Formatted: Justified, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm + 7 cm

Formatted: Not Superscript/ Subscript

Formatted: Justified, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers, Tab stops: Not at 0.7 cm + 1.4 cm + 2.1 cm + 2.8 cm + 3.5 cm + 4.2 cm + 4.9 cm + 5.6 cm + 6.3 cm + 7 cm

Formatted: Not Superscript/ Subscript

Formatted

Formatted: None, Adjust space between Latin and Asian text, Adjust space between Asian text and numbers

3.1.20

centre of panel

COP

area of the *vacuum insulation panel (VIP)* $\frac{(3.1.1)(3.1.1)}{(3.1.21)}$ not affected by the *edge effect* $\frac{(3.1.21)(3.1.21)}{(3.1.21)}$

3.1.21

edge effect

thermal bridging along the edge due to higher thermal conductivity of the outer <u>envelope</u> (3.1.5)(3.1.5) compared to the <u>core material</u> (3.1.4)(3.1.4)

3.1.22

aged value

expected mean thermal conductivity value at 25 years in specified laboratory conditions

3.2 Symbols and units

A	surface area of the VIP	m ²
Am	metering area of the GHP or HFM apparatus used for	m ²
	measurement	
A _N	nominal surface area of the VIP	m ²
A_{sp}	area of the specimen measured by hot box method	m ²
$A_{ m sur}$	surface area of gas permeation plane of the product	m ²
$A_{ m sur,sp}$	surface area of gas permeation plane of the specimen	m²
$\mathcal{C}_{\mathrm{des}}$	capacity of the desiccant	g/g
C _{des,20%}	capacity of the desiccant including a safety margin of 20 $\%$	g/g
d <u>.</u>	Thickness thickness 180 164/8	m,
d _{ambient} https://	thickness of the ventilated VIP	1-0048-4421-
d_{N}	nominal thickness of the product	m,
$d_{ m VIP}$	thickness of the VIP	m,
$f_{ m air}$	acceleration factor for dry air of the envelope	-
$f_{\mathbf{v}}$	acceleration factor for water vapour of the VIP envelope	-
k.	factor related to the number of test results available	4
I <u>.</u>	<u>Length</u> length	m,
l _c	core length	m
l _{es}	length of edge seal	m
I_{w}	working length	m
I_{Ψ}	length of the joints within the metering area	m
m_1	initial water amount of core material	g
m_2	amount of adsorbed water vapour	g
m _{25a}	water vapour amount adsorbed over 25 years	g
$m_{ m des}$	mass of desiccant	g

 \odot ISO 2022 — All rights reserved

Formatted Formatted Formatted Formatted Formatted Formatted Formatted

© ISO 2023 – All rights reserved

Formatted	
Formatted	
Formatted	()
Formatted Table	
Formatted	()
Formatted	
Formatted	<u></u>
Formatted	
Formatted	()
Formatted	
Formatted	()
Formatted	()
Formatted 2007/iso-	()
Formatted	()
Formatted	
Formatted	<u></u>
Formatted	<u></u>
Formatted	<u></u>
Formatted	
Formatted	<u></u>
Formatted	

8

Formatted Formatted

Formatted Formatted

$m_{\mathrm{des,1a}}$	mass of the desiccant after test	g
$m_{ m des,1d}$	sufficient amount of desiccant	g
$m_{ m des,2a}$	mass of the desiccant before acceleration test	g
$m_{\mathrm{des,2c}}$	mass of the desiccant after acceleration test	g
$m_{\mathrm{des,0}}$	mass of the fully dried desiccant	g
m _{des,sat}	mass of the saturated desiccant	g
m' _{t,air, 23/50}	inner dry air mass increase rate at 23 °C, 50 % relative humidity (RH)	g/day
m' _{t,v,23/50}	water vapour mass increase rate at 23 °C, 50 % RH	g/day
N.	number of test results	7
P_{air}	air permeability of the VIP envelope	m ³ ·Pa/(m ² ·s)
P _{air,total,23/50}	air permeability of the VIP envelope of the product at 23 °C, 50 $\%$ RH	g/(day·Pa)
Pair,total,sp,23/50	air permeability of the VIP envelope of the specimen at 23 °C, $50\ \%$ RH	g/(day·Pa)
Pair,A,23/50	air permeability of the film surface at 23 °C, 50 % RH	g/(m²·day·Pa)
Pair,l,23/50	air permeability of the edge seal at 23 °C, 50 % RH	g/(m·day·Pa)
$P_{\rm v}$	water intake rate of the VIP envelope	kg/(m ² ·s)
$p_{\rm air}$	air pressure inside the VIP	Pa
p _{air,atm}	atmospheric pressure	Pa
p _{lim} https://	maximum value of the inner pressure measured at least 24 hours after production 200/standards/sist/ae()00f5d	Pa -d648-4421
$p_{v_{\bullet}}$	water vapour pressure inside the VIP 16478	Pa
$p_{ m v,out}$	atmospheric water vapour pressure	Pa
p_0	initial value of the inner pressure	Pa
<i>p</i> _{1/2}	inner pressure of VIP, where λ increases where λ increases by 1/2 of the thermal conductivity of still air	Pa
p' _{t,air,23/50}	inner pressure increase rate at 23 °C, 50 % RH	Pa/day
p' _{t,air,40}	inner pressure increase rate at 40 °C	Pa/day
p' _{t,air,60}	inner pressure increase rate at 60 °C	Pa/day
p' _{t,air,80}	inner pressure increase rate at 80 °C	Pa/day
R _{aux}	thermal resistance of the auxiliary material	m²⋅K/W
R_{D}	declared thermal resistance	m²⋅K/W
$R_{ m eq}$	thermal resistance obtained by assuming the entire surface to be homogeneous calculated by the thermal transmittance	m ² ·K/W
$R_{s,t}$	total surface thermal resistance	m²⋅K/W
R _{mean}	mean thermal resistance	m ² ·K/W

Formatted
Formatted

© ISO 2022 — All rights reserved

© ISO 2023 - All rights reserved

Formatted Formatted

R_{tot}	thermal resistance of VIP plus auxiliary material	m ² ·K/W
R _{90/90}	90 % fractile with a confidence level of 90 % for the thermal resistance	m²·K/W
S	top surface area (working length x working width) of the VIP	m²
S_{b}	deviation from squareness on width or length	mm/m
S_{MAX}	deviation from flatness	mm
S _N	nominal perimeter of the product	m,
Sλ	estimate of the standard deviation of the thermal conductivity	W/(m·K)
T_	Temperaturetemperature	K
t	<u>Timetime</u>	s
$t_{ m des}$	lifetime of desiccant	a
U_	thermal transmittance	W/(m²⋅K)
V_	core volume of the product	m³
$V_{\rm sp}$	core volume of the specimen	m³
$V_{ m void}$	void volume of core	m³
w_	Widthwidth Clinical And DANIDA	m
w_{c}	core width	m
Wes	width of edge seal	th.al)
w _w	working width	m,
X.	water content inside the VIP ISO 16478	mass-%
λair httms://	thermal conductivity of still air, /ctandards/sist/ae000 f5	W/(m·K),
λ _{ambient}	thermal conductivity of a ventilated VIP at centre of the panel	W/(m·K)
λ_{cop}	thermal conductivity for centre of panel	W/(m·K)
$\lambda_{\text{cop,mean}}(25 \text{ years})$	average value of thermal conductivity over 25 years in use at centre of panel	W/(m·K)
$\lambda_{\text{cop,90/90,aged}}$	$\lambda_{90/90}$ at centre of panel plus ageing	W/(m·K)
λ_{D}	declared thermal conductivity	W/(m·K)
$\lambda_{ m eq}$	thermal conductivity including edge effect	W/(m·K)
$\lambda_{ m eq,ja}$	equivalent thermal conductivity including edge effect	W/(m·K)
$\lambda_{ ext{mean}}$	mean value of thermal conductivity	W/(m·K)
λ _i	one test result of thermal conductivity	W/(m·K)
λ_0	thermal conductivity in the evacuated state	W/(m·K)
λ'p	change of thermal conductivity with pressure	W/(m·K·Pa)
λ't	change of thermal conductivity with time	W/(m·K·s)
$\lambda_{ m VIP}$	thermal conductivity of the VIP	W/(m·K)

Formatted	<u> </u>
Formatted	(
Formatted	
Formatted	
Formatted	
Formatted	
Formatted	<u></u>
Formatted	
Formatted	<u></u>
Formatted	
Formatted	(
Formatted	(
Formatted	
Formatted	
Formatted	
Formatted 808362/iso-	
Formatted	[
Formatted	
Formatted	
Formatted	
Formatted	<u></u>
Formatted	
Formatted	<u></u>
Formatted	
Formatted	<u></u>
Formatted	
Formatted	
Formatted	
Formatted	
Formatted	<u></u>
Formatted	$\overline{}$

Formatted Formatted

10

10

© ISO 2022 All rights reserved

Formatted

© ISO 2023 – All rights reserved

λ'χ	change of thermal conductivity with humidity	W/(m·K)/mas
λ _{90/90}	90 % fractile with a confidence level of 90 % of thermal conductivity.	W/(m·K)
λ' _{t,23/50}	change of thermal conductivity with time at 23 °C 50 % RH	W/(m·K·s)
λ' _{t,50/70}	change of thermal conductivity with time at 50 °C 70 % RH	W/(m·K·s)
$\lambda_{\text{cop}}(t)$	time-dependent thermal conductivity value	W/(m·K)
$\lambda(t)_{,23/50}$	time dependent value of thermal conductivity at 23 °C 50 % RH	W/(m·K·s)
$\lambda(t)$,50/70	time dependent value of thermal conductivity at 50 °C 70 % RH	W/(m·K·s)
$\lambda^*(t=0)$	interpolated initial thermal conductivity	W/(m·K)
$\sigma_{ m mt}$	tensile strength perpendicular to faces	kPa
σ_{10}	compressive stress at 10 % deformation	kPa
φ	RH inside the VIP	%
φ' _x	change of RH inside the VIP as function of water content	(rel. humidity-%) /(mass-%)
$\Phi_{ m in}$	quantity of heat generated in the hot box	W
$\Phi_{ m l}$	quantity of heat loss from the hot box	W
$\Phi_{ m sur}$	quantity of heat flow through the surround panel	w_ all
ψ_{\bullet}	linear thermal transmittance	W/(m·K)
ψ_{m}	linear thermal transmittance for the joints in the metering area	W/(m·K)
$\Delta\theta_{\rm n}$ https://	environmental temperature difference between both sides of the specimen	- K 648-442f

4 Requirements

4.1 General

Products shall be assessed in accordance with Clause 6 and meet the requirements as outlined in Clause 4. Clause 4.

All characteristics defined in Clause 4, Clause 4, if declared, shall be subject to product type determination (PTD) in accordance with Annex E. The minimum frequencies of tests in the factory production control (FPC) shall be in accordance with Annex E. Annex E.

NOTE The manufacturer can choose to give information for additional properties (see Annex F). Annex F).

4.2 Thermal resistance and thermal conductivity

4.2.1 General

Requirements of thermal resistance and thermal conductivity are given in Table 1.

Table 1 — Thermal resistance and thermal conductivity

© ISO 2022 – All rights reserved

© ISO 2023 - All rights reserved

Formatted Formatted **Formatted** Formatted **Formatted** Formatted Formatted Formatted Formatted **Formatted** Formatted **Formatted** Formatted **Formatted Formatted** Formatted **Formatted** Formatted **Formatted** Formatted Formatted Formatted **Formatted Formatted** Formatted **Formatted Formatted** Formatted Formatted **Formatted Formatted Formatted Formatted** Formatted Formatted Formatted **Formatted** Formatted Formatted **Formatted** Formatted **Formatted** Formatted **Formatted**

Formatted

Formatted Formatted

Formatted