Fraunhofer-Institut für Bauphysik IBP
Bauaufsichtlich anerkannte Stelle für
Prüfung, Überwachung und Zertifizierung
Institutsleitung
Prof. Dr. Philip Leistner

Test Report P1-026e/2024

Determination of the Thermal Resistance and the Thermal Conductivity According to EN 12664 of thermal break “polyamid low lambda bars” Batch 1

Client:
PRODUCTA s.r.l
Via F. Giulietti, 4 – Z ind.le E. Fermi
62010 Montelupone (MC)
Italy

Stuttgart, January 22, 2024

Deutsche Akkreditierungsstelle D-PL-11140-11-00

Prüflaboratorium
durch DAkkS GmbH akkreditiert nach
DIN EN ISO/IEC 17025:2018

Prüfstelle Wärmekennwerte
Nobelstraße 12 | 70569 Stuttgart
Telefon +49 711 970-3333
www.pruefstellen.ibp.fraunhofer.de

Thermal resistance and thermal conductivity according to DIN EN 12664: 2001-05

Test method/test equipment/ installation of test specimens	Single Guarded-hot-plate method, 150 mm test apparatus no. 9 with heated protective ring, horizontal installation of test specimens, sample consists of several stripes of the thermal break placed next to each other
Test period	Calendar week 3 in 2024

Test specimens manufacturer information:

Description of test specimens	"polyamid low lambda bars"
Material	Extrudes stripes of polyamid PA-6,6 with 25 % of fiber glass

Test specimens laboratory data:

IBP-QM-no.		23-301-1	
Sampling		Delivered on December 13, 2023 by client	
Pre-treatment		Storing at 23 °C/50 % RH untill mass constancy is reached (according to DIN EN 10077-2)	
Measured specimen parameters		Sample 1	Sample 2
Density after pre-treatment	kg/m³	841.5	826.7
Relative mass change after pre-treatment	kg/kg	0.010	0.010
Length x width x thickness before measurement	mm	300 x 296 x 25.1	302 x 300 x 25.2
Length x width x thickness after measurement	mm	300 x 296 x 25.1	302 x 300 x 25.2
Relative mass change	kg/kg	0.000	0.000
Density after measurement	kg/m³	841.3	826.6

Results:

Measure-ment no.	Mean temperature of the sample surface		Mean temperature difference	Mean temperature of samples	Heat flux density	Thermal resistance R	Thermal conductivity λ
	Hot plate side	Cold plate side					
	°C	°C	K	°C	W/m²	m²·K/W	W/(m·K)
1	17.3	2.2	15.2	9.7	108.3	0.139	0.1811

Temperature corrections factor for contact mats $f_r = 0.99$.
Estimated measurement uncertainty 5 % according to DIN EN 12664.

Special note:
The results exclusively refer to the tested object.

The test laboratory is recognized by the Deutsches Institut für Bautechnik (DIBt) as a testing facility under applicable building regulations LBO as "PÜZ-Stelle" No. BWU-10 and as a Notified Body No. 1004 to the terms of the Regulation of Construction Products (EU-BauPVO). It has been granted flexible accreditation under DIN EN ISO/IEC 17025 by the Deutsche Akkreditierungsstelle GmbH (DAkkS) under accreditation No. D-PL-11140-11-00.

This test report consists of 2 pages.

Stuttgart, January 22, 2024/JL

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Bauaufsichtlich anerkannte Stelle für
Prüfung, Überwachung und Zertifizierung
Institutsleitung
Prof. Dr. Philip Leistner

Test Report P1-027e/2024

Determination of the Thermal Resistance and the Thermal Conductivity According to EN 12664 of thermal break “polyamid low lambda bars” Batch 2

Client:
PRODUCTA s.r.l
Via F. Giulietti, 4 – Z ind.le E. Fermi
62010 Montelupone (MC)
Italy

Stuttgart, January 22, 2024

Deutsche Akkreditierungsstelle D-PL-11140-11-00

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Thermal resistance and thermal conductivity according to DIN EN 12664: 2001-05

Test method/test equipment/ installation of test specimens	Single Guarded-hot-plate method, 150 mm test apparatus no. 9 with heated protective ring, horizontal installation of test specimens, sample consists of several stripes of the thermal break placed next to each other
Test period	Calendar week 3 in 2024

Test specimens manufacturer information:

Description of test specimens	"polyamid low lambda bars"
Material	Extrudes stripes of polyamid PA-6,6 with 25 % of fiber glass

Test specimens laboratory data:

IBP-QM-no.		23-301-2	
Sampling		Delivered on December 13, 2023 by client	
Pre-treatment		Storing at 23 °C/50 % RH untill mass constancy is reached (according to DIN EN 10077-2)	
Measured specimen parameters		Sample 1	Sample 2
Density after pre-treatment	kg/m³	834.8	834.1
Relative mass change after pre-treatment	kg/kg	0.010	0.010
Length x width x thickness before measurement	mm	311 x 300 x 25.1	302 x 300 x 25.1
Length x width x thickness after measurement	mm	311 x 300 x 25.1	302 x 300 x 25.1
Relative mass change	kg/kg	0.000	-0.001
Density after measurement	kg/m³	834.6	833.7

Results:

Measure-ment no.	Mean temperature of the sample surface		Mean temperature difference	Mean temperature of samples	Heat flux density	Thermal resistance R	Thermal conductivity λ
	Hot plate side	Cold plate side					
	°C	°C	K	°C	W/m²	m²·K/W	W/(m·K)
1	17.4	2.1	15.4	9.7	112.5	0.135	0.1854

Temperature corrections factor for contact mats $f_r = 0.99$.
Estimated measurement uncertainty 5 % according to DIN EN 12664.

Special note:
The results exclusively refer to the tested object.

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This test report consists of 2 pages.

Stuttgart, January 22, 2024/JL

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Bauaufsichtlich anerkannte Stelle für
Prüfung, Überwachung und Zertifizierung
Institutsleitung
Prof. Dr. Philip Leistner

Test Report P1-028e/2024

Determination of the Thermal Resistance and the Thermal Conductivity According to EN 12664 of thermal break “polyamid low lambda bars” Batch 3

Client:
PRODUCTA s.r.l
Via F. Giulietti, 4 – Z ind.le E. Fermi
62010 Montelupone (MC)
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Stuttgart, January 22, 2024

Deutsche Akkreditierungsstelle D-PL-11140-11-00

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Thermal resistance and thermal conductivity according to DIN EN 12664: 2001-05

Test method/test equipment/ installation of test specimens	Single Guarded-hot-plate method, 150 mm test apparatus no. 9 with heated protective ring, horizontal installation of test specimens, sample consists of several stripes of the thermal break placed next to each other
Test period	Calendar week 3 in 2024

Test specimens manufacturer information:

Description of test specimens	"polyamid low lambda bars"
Material	Extrudes stripes of polyamid PA-6,6 with 25 % of fiber glass

Test specimens laboratory data:

IBP-QM-no.		23-301-3	
Sampling		Delivered on December 13, 2023 by client	
Pre-treatment		Storing at 23 °C/50 % RH untill mass constancy is reached (according to DIN EN 10077-2)	
Measured specimen parameters		Sample 1	Sample 2
Density after pre-treatment	kg/m³	838.2	833.9
Relative mass change after pre-treatment	kg/kg	0.010	0.009
Length x width x thickness before measurement	mm	300 x 299 x 25.1	300 x 300 x 25.2
Length x width x thickness after measurement	mm	300 x 299 x 25.1	300 x 300 x 25.2
Relative mass change	kg/kg	0.000	0.000
Density after measurement	kg/m³	838.2	833.8

Results:

Measure-ment no.	Mean temperature of the sample surface		Mean temperature difference	Mean temperature of samples	Heat flux density	Thermal resistance R	Thermal conductivity λ
	Hot plate side	Cold plate side					
	°C	°C	K	°C	W/m²	m²·K/W	W/(m·K)
1	17.4	2.1	15.3	9.7	113.1	0.134	0.1881

Temperature corrections factor for contact mats $f_r = 0.99$.
Estimated measurement uncertainty 5 % according to DIN EN 12664.

Special note:
The results exclusively refer to the tested object.

The test laboratory is recognized by the Deutsches Institut für Bautechnik (DIBt) as a testing facility under applicable building regulations LBO as "PÜZ-Stelle" No. BWU-10 and as a Notified Body No. 1004 to the terms of the Regulation of Construction Products (EU-BauPVO). It has been granted flexible accreditation under DIN EN ISO/IEC 17025 by the Deutsche Akkreditierungsstelle GmbH (DAkkS) under accreditation No. D-PL-11140-11-00.

This test report consists of 2 pages.

Stuttgart, January 22, 2024/JL

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Statement P1-029e/2024

Measurements of the Thermal Conductivity and Determination of the Nominal Value and Design Value of Thermal Breaks for Use in Window Frames “polyamid low lambda bars“

Client:
PRODUCTA s.r.l
Via F. Giulietti, 4 – Z ind.le E. Fermi
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Stuttgart, January 22, 2024

Deutsche Akkreditierungsstelle D-PL-11140-11-00

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1 Task

The Fraunhofer Institute for Building Physics IBP was ordered by PRODUCTA s.r.l, Italy, to determine the nominal value of the thermal break for use in window frames "polyamid low lambda bars" according to DIN EN ISO-10077-2 and by means of the statistical method according to DIN EN ISO 10456, Annex C. This determination was based on measured values of the thermal conductivity at the Fraunhofer Institute for Building Physics IBP.

2 Description of the Method

The standard DIN EN ISO 10456 [1] describes a method to determine the nominal values of the thermal insulation of building materials and products. The wanted nominal value of the thermal conductivity $\lambda_{90/90}$ can be calculated from the mean value of the measured thermal conductivities $\overline{\lambda}$, the standard deviations of these measured values s, and a coefficient k_2 specified for a unilateral 90 % tolerance interval with a 90 % level of confidence and presented in dependence of the number of measurements in Table C.1 in [1]. For applications where the boundary conditions of the sample conditioning according to DIN EN ISO 10077-2 [2] for the thermal conductivity measurements can be assigned to the practical use, the nominal value can be used directly as the design value of the thermal conductivity according to 6.1 in [1]. The samples were conditioned at 23 °C and 50 % RH according to [2]. Therefore the nominal value is equal to the design value of the thermal conductivity for the application in window frames.

3 Result

The measured values of the thermal conductivity according to the standard DIN EN 12664 after conditioning at 23 °C/50 % RH are documented in the following test reports:

P1-026/2024: Thermal conductivity = 0.1811W/(m·K)
P1-027/2024: Thermal conductivity = 0.1854 W/(m·K)
P1-028/2024: Thermal conductivity = 0.1881 W/(m·K)

The mean value of the thermal conductivity is $\overline{\lambda}$ = 0.18485 W/(m·K), the estimate of standard deviation of the thermal conductivity is s = 0.003521 W/(m·K) and the coefficient k_2 according to [1] is k_2 = 4.26.

Therefore, the nominal value and the design value of the thermal conductivity of thermal break for use in window frames "polyamid low lambda bars" determined on the basis of these input data is

$$\lambda_{90/90} = 0.200 \text{ W/(m·K)}.$$

4 References

[1] DIN EN ISO 10456:2010-05: Baustoffe und Bauprodukte - Wärme- und feuchtetechnische Eigenschaften - Tabellierte Bemessungswerte und Verfahren zur Bestimmung der wärmeschutztechnischen Nenn- und Bemessungswerte (ISO 10456:2007 + Cor. 1:2009); Deutsche Fassung EN ISO 10456:2007 + AC:2009. Beuth-Verlag, Berlin.

[2] DIN EN ISO 10077-2:2018-01: Wärmetechnisches Verhalten von Fenstern, Türen und Abschlüssen - Berechnung des Wärmedurchgangskoeffizienten - Teil 2: Numerisches Verfahren für Rahmen (ISO 10077-2:2017); Deutsche Fassung EN ISO 10077-2:2017. Beuth-Verlag, Berlin.

Note: This statement exclusively refers to the tested materials.

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This statement comprises 2 pages.

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