# Evidence of Performance
## Calculation of thermal transmittance

**Test Report**
**No. 16-003857-PR01**
(PB-K20-06-en-01)

ift ROSENHEIM

**Client**
PROFI TIM d.o.o.
Bulevar 12 februar 129
18000 18000 Nis
Serbia

**Product**
Wood-aluminium profiles
Profile combination: Casement-frame

Designation: Windows system ALD 100 / ALD 120

Performance-relevant product details: Material **spruce / aluminium alloys;** Surface treatment **painted / powder coated or painted;** View width B in mm **126; Casement;** Item number **PTD-K90 / PTD-K68;** width x thickness in mm **82 x 100 to 122; Frame;** Item number **PTD-S90 / PTD-S68;** width x thickness in mm **90 x 81 to 103; Glazing;** Total thickness in mm **50 / 24;** Configuration in mm **6/16/6/16/6 / 4/16/4;** Thermal transmittance $U_g$ in W/(m²K) **0.5 / 1.1 (as specified by client); Spacer;** System designation **TGI Spacer (Two-Box model acc. to BF-Datasheet Nr. W9 / 2013); Replacement panel;** Edge cover in mm **13;** Thickness in mm **50/24**

Special features: -/-

**Results**

**Calculation of thermal transmittance and linear thermal transmittance, according to EN ISO 10077-2:2012-02**

$$U_f = 0{,}96 \text{ to } 1{,}2\ W/(m^2K)$$
$$\Psi_g = 0{,}041 \text{ to } 0{,}042\ W/(mK)$$

**ift Rosenheim**
**26.01.2017**

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**Basis** *)

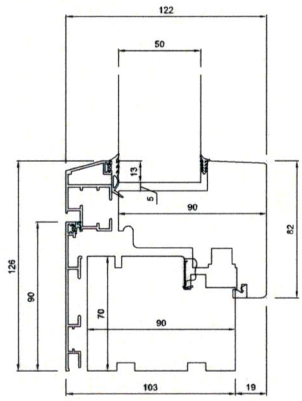
EN ISO 10077-2:2012-02

SG 06-verpflichtend
NB-CPD/SG06/11/083 2011-09

*) Correspond/s to the national standard/s (e.g. DIN EN)

**Representation**

Test specimen PK01




Further drawings see annex

**Instructions for use**

The results obtained can be used as evidence in accordance with the above basis.

**Validity**

The data and results given relate solely to the tested and described specimen. This test does not allow any statement to be made on further characteristics of the present structure regarding performance and quality.

**Notes on publication**

The ift-Guidance Sheet "Conditions and Guidance for the Use of ift Test Documents" applies. The document may only be published in full.

**Contents**

The report contains a total of 7 page/s and annexe (3 pages).

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Prüfung und Kalibrierung – EN ISO/IEC 17025
Inspektion – EN ISO/IEC 17020
Zertifizierung Produkte – EN ISO/IEC 17065
Zertifizierung Managementsysteme – EN ISO/IEC 17021

Notified Body 0757
PÜZ-Stelle: BAY 18

DAkkS Deutsche Akkreditierungsstelle D-PL-11349-01-00

# 1 Object

## 1.1 Description of test specimen

**Wood-aluminium profile**
**Profile combination: Casement-frame**

| | |
|---|---|
| Manufacturer | PROFI TIM d.o.o. |
| System designation | Windows system ALD 100 / ALD 120 |
| Material | Laminated wood profile (spruce) / aluminium alloys |
| Surface treatment | Painted / powder coated or painted |
| View width B in mm | 126 |
| **Glazing** | |
| Thermal transmittance $U_g$ in W/(m$^2$K) | 0.5 / 1.1 (as specified by client) |
| Total thickness in mm | 50 / 24 |
| Configuration in mm | 6/16/6/16/6<br>4/16/4 |
| **Spacer** | |
| System designation | TGI Spacer - Calculated by two-box-model acc. to BF-Datasheet Nr. W09 / 2013 |
| Manufacturer | Technoform Glass Insulation GmbH |
| **Replacement panel** | |
| Length in mm | 190 |
| Edge cover in mm | 13 |
| Thickness in mm | 50 / 24 |

| **Test specimen** | **PK01** | **PK02** | **PK03** |
|---|---|---|---|
| Sealing system | 1 x external<br>1 x centre<br>1 x internal | 1 x external<br>2 x centre<br>1 x internal | 1 x external<br>2 x centre<br>1 x internal |
| **Casement** | | | |
| Item number | PTD-K90 | PTD-K90 | PTD-K90 |
| Profile cross section width in mm (total / wood profile) | 82 / 82 | 82 / 82 | 82 / 82 |
| Profile cross section thickness in mm (total / wood profile) | 122 / 90 | 122 /90 | 122 / 90 |
| **Facing Profile** | | | |
| Item number | PTP 02 | PTP 02 | PTP 02 |
| Profile cross section width in mm | 42 | 42 | 42 |
| Profile cross section thickness in mm | 28 | 28 | 28 |
| **Frame** | | | |
| Item number | PTD-S90 | PTD-S90 | PTD-S90 |
| Profile cross section width in mm (total / wood profile) | 90 / 70 | 90 / 70 | 90 / 70 |
| Profile cross section thickness in mm (total / wood profile) | 103 / 90 | 103 / 90 | 103 / 90 |
| **Facing Profile** | | | |
| Item number | PTP 01 | PTP 01 | PTP 01 |
| Profile cross section width in mm | 90 | 90 | 90 |
| Profile cross section thickness in mm | 10 | 10 | 10 |
| **Glazing** | | | |
| Total thickness in mm | -/- | -/- | 50 |
| **Replacement panel** | | | |
| Total thickness in mm | 50 | 50 | -/- |

| **Test specimen** | **PK04** | **PK05** | |
|---|---|---|---|
| Sealing system | 1 x external<br>2 x centre<br>1 x internal | 1 x external<br>2 x centre<br>1 x internal | |
| **Casement** | | | |
| Item number | PTD-K68 | PTD-K68 | |
| Profile cross section width in mm (total / wood profile) | 82 / 82 | 82 / 82 | |
| Profile cross section thickness in mm (total / wood profile) | 100 / 68 | 100 / 68 | |
| **Facing Profile** | | | |
| Item number | PTP 02 | PTP 02 | |
| Profile cross section width in mm | 42 | 42 | |
| Profile cross section thickness in mm | 28 | 28 | |
| **Frame** | | | |
| Item number | PTD-S68 | PTD-S68 | |
| Profile cross section width in mm (total / wood profile) | 90 / 70 | 90 / 70 | |
| Profile cross section thickness in mm (total / wood profile) | 81 / 68 | 81 / 68 | |
| **Facing Profile** | | | |
| Item number | PTP 01 | PTP 01 | |
| Profile cross section width in mm | 90 | 90 | |
| Profile cross section thickness in mm | 10 | 10 | |
| **Glazing** | | | |
| Total thickness in mm | -/- | 24 | |
| **Replacement panel** | | | |
| Total thickness in mm | 24 | -/- | |

The description is based on specifications provided by the client and on inspection of the test specimen at the **ift.** (Item designations/ numbers as well as material specifications were provided by the client, unless designated as „*ift-tested*".)

Test specimen are described in the annex "Product/Sample description".

## 1.2 Sampling

The following data for sampling have been presented to **ift**:

Sampler: PROFI TIM d.o.o., 18000 18000 Nis (Serbia)

Datum: 19.01.2017

Documentation: ift Rosenheim did not receive a sampling report.

**ift**-test specimen-No.: 16-003857-PK01

# 2 Procedure

## 2.1 Basic documents *) of the processes

EN ISO 10077-2:2012-02
Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 2 - Numerical method for frames

SG 06-verpflichtend NB-CPD/SG06/11/083 2011-09
EN 14351-1:2006 Treatment of unventilated rectangular cavities when calculating thermal properties to EN ISO 10077-2

*) correspond/s to the national standard/s, e.g. DIN EN

## 2.2 Short description of process

<u>Calculation of thermal transmittance and linear thermal transmittance $U_f$ / $\Psi$</u>
The profile section is subdivided into a sufficient number of elements; with subdivision into smaller elements not having any effect on the total heat flow. The relevant materials / boundary conditions are determined and the total heat flow calculated. The heat flow is used to determine the thermal transmittance and linear thermal transmittance.

# 3 Detailed results

## Calculation of thermal transmittance and linear thermal transmittance

| | |
|---|---|
| **Project No.** | 16-003857-PR01 **Task No.** 16-003857 |
| **Basis of testing** | EN ISO 10077-2:2012-02<br>Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 2 - Numerical method for frames<br>SG 06-verpflichtend NB-CPD/SG06/11/083 2011-09<br>EN 14351-1:2006 Treatment of unventilated rectangular cavities when calculating thermal properties to EN ISO 10077-2 |
| **Test equipment used** | Sim/020990 - flixo 7.0 |
| **Test specimen** | Wood-Aluminium profile<br>Profile combination: Casement-frame |
| **Number of test specimen** | 16-003857-PK01 |
| **Date of test** | 19.01.2017 |
| **Testing personnel in charge** | Till Stübben |
| **Test personnel** | Till Stübben |

## Information on test setup / test method

**Test method** There are no deviations of the testing method according to the standards.

## Boundary Conditions

| | Boundary conditions | | Values | Source[1] |
|---|---|---|---|---|
| $\theta_{ni}$ | Air temperature inside | °C | 20 | -/- |
| $\theta_{ne}$ | Air temperature outside | °C | 0 | -/- |
| $\Delta T$ | Temperature difference | K | 20 | -/- |
| $R_{si}$ | Internal heat transfer resistance | (m²·K)/W | 0,13 | -/- |
| $R_{si}$ | Internal heat transfer resistance (increased) | (m²·K)/W | 0,20 | -/- |
| $R_{se}$ | External heat transfer resistance | (m²·K)/W | 0,04 | -/- |

## Material properties

| | Material properties | | Values | Source[1] |
|---|---|---|---|---|
| $\varepsilon_n$ | Emissivities | | 0,9 | -/- |
| $\lambda$ | Thermal conductivity aluminium (Si - alloy) | W/(m⊙K) | 160 | -/- |
| $\lambda$ | Thermal conductivity spruce (PCAB) | W/(m⊙K) | 0,11 | -/- |
| $\lambda$ | Thermal conductivity EPDM (ethylene propylene diene monomer) | W/(m⊙K) | 0,25 | -/- |
| $\lambda$ | Thermal conductivity elastomer foam | W/(m⊙K) | 0,050 | -/- |
| $\lambda$ | Thermal conductivity PVC (polyvinylchloride), rigid | W/(m⊙K) | 0,17 | -/- |
| $\lambda$ | Thermal conductivity float glass | W/(m⊙K) | 1,0 | -/- |
| $\lambda$ | Thermal conductivity Two-Box Model "Polysulfide" Box 1 ( h = 3 mm) | W/(m⊙K) | 0,40 | BF-Data Sheet Nr. W9 - 2013-04 |
| $\lambda$ | Thermal conductivity Two-Box Model "TGI Spacer" Box 2 ( h = 6,9 mm) | W/(m⊙K) | 0,30 | BF-Data Sheet Nr. W9 - 2013-04 |
| $\lambda$ | Thermal conductivity gas filling triple IGU $U_g$ = 0,5 W/(m²K) | W/(m⊙K) | 0,018 | Client |
| $\lambda$ | Thermal conductivity gas filling double IGU $U_g$ = 1,1 W/(m²K) | W/(m⊙K) | 0,022 | Client |
| $\lambda$ | Thermal conductivity replacement panel EN ISO 10077-2 | W/(m⊙K) | 0,035 | -/- |

[1] Unless stated otherwise, data originate form standards EN ISO 10456 and EN ISO 10077-2.

## Determination of thermal transmittance $U_f$ and the linear thermal transmittance $\Psi$

Thermal transmittance of a frame profile is calculated as described below:

$$U_f = \frac{L_f^{2D} - U_p \cdot b_p}{b_f}$$

The linear thermal transmittance of the joint frame-glazing or frame-panel is calculated as described below:

$$\Psi_g = L_\Psi^{2D} - U_f \times b_f - U_g \times b_g$$

or

$$\Psi_p = L_\Psi^{2D} - U_f \times b_f - U_p \times b_p$$

| | Definitions | Units |
|---|---|---|
| $U_f$ | thermal transmittance of frame profile | W/(m²K) |
| $\Psi$ | linear thermal transmittance | W/(mK) |
| $b_{ges}$ | total width | m |
| $b_f$ | projected width of frame profile | m |
| $b_p$ | visible width of replacement panel | m |
| $b_g$ | sichtbare Breite der Verglasung | m |
| $d_p$ | thickness of filling / panel | m |
| $d_g$ | thickness of glazing | m |
| $U_p$ | thermal transmittance of filling / panel | W/(m²K) |
| $U_g$ | thermal transmittance in the middle area of the glazing | W/(m²K) |
| $U_f$ | thermal transmittance of frame profile | W/(m²K) |
| $Q_{ges}$ | heat flux density | W/m |
| $L_\Psi^{2D}$ | zweidimensionaler thermischer Leitwert | W/(mK) |

| Sp-No. | Remark | $b_{ges}$ | $b_f$ | $b_{Füllung}$ | $d_{Füllung}$ | $Q_{ges}$ | $L_\Psi^{2D}$ | $U_p$ | $U_g$ | $U_f$ |
|---|---|---|---|---|---|---|---|---|---|---|
| Sp-No.01 | Frame-Profile 01 | 0,317 | 0,127 | 0,190 | 0,050 | 4,893 | 0,245 | 0,626 | | 0,99 |
| Sp-No.02 | Frame-Profile 02 | 0,317 | 0,127 | 0,190 | 0,050 | 4,809 | 0,240 | 0,626 | | 0,96 |
| Sp-No.03 | TGI Spacer / triple IGU 50 mm | 0,317 | 0,127 | 0,190 | 0,050 | 5,150 | 0,258 | | 0,5 | |
| Sp-No.04 | Frame-Profile 03 | 0,317 | 0,127 | 0,190 | 0,024 | 7,473 | 0,374 | 1,169 | | 1,20 |
| Sp-No.05 | TGI Spacer / double IGU 24 mm | 0,317 | 0,127 | 0,190 | 0,024 | 8,056 | 0,403 | | 1,1 | |

## Test Result

Calculated thermal transmittance

| | | |
|---|---|---|
| Sp-No.01 | $U_f$ = | **0,99 W/m² K** |
| Sp-No.02 | $U_f$ = | **0,96 W/m² K** |
| Sp-No.03 | $\Psi$ = | **0,041 W/m K** |
| Sp-No.04 | $U_f$ = | **1,2 W/m² K** |
| Sp-No.05 | $\Psi$ = | **0,042 W/m K** |