

Calculation of Thermal Transmittance

Report in Accordance with BS EN ISO 10077-1:2017

Thermal Performance of Windows, Doors & Shutters

CONFIDENTIAL

Report reference:	U25-008-9A
Prepared for:	Bereco Ltd Unit 5 Aspen Court Centurion Business Park Rotherham, S60 1FB
Project:	Lipped French Door – Opening Out
Issued by:	Sue Peatey
Issue date:	9 April 2025



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1 Introduction

This document details the thermal performance calculation of the door configuration as detailed below.

The results in this report relate only to the simulated specimen using the drawings and specification received.

The frame profile results detailed below are provided by computer simulation using LBL software program THERM 5.2 and validated against proofs in Annex I (I1 to I10) of BS EN ISO 10077-2:2017.

The frame profile results detailed below are provided from methods contained in BS EN ISO 10077-1:2017 and in accordance with thermal transmittance requirements detailed in BS EN 14351-1:2006 +A1:2010. Cavities are calculated in accordance with BS EN ISO 10077-2 section 6.4.3 Treatment of cavities using the single equivalent thermal conductivity method.

2.0 Authorisation

Report Issued By:	Sue Peatey Technical Officer	
Report Checked By:	Richard Bate Technical Director	

3 Results

3.1 U-Value

The thermal performance of the door (U_w) in accordance with EN ISO 10077-1:2017 is:

1.3 W/m²K

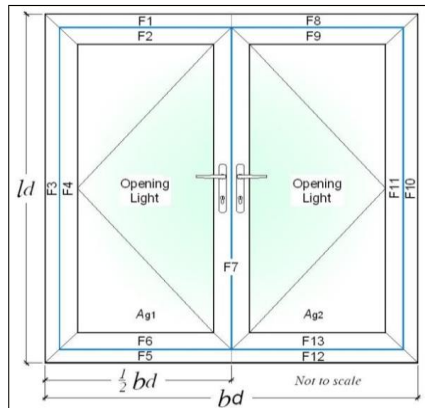
3.2 Frame thermal transmittance and linear thermal transmittance (in accordance with BS EN ISO 10077-1: 2017)

Frame Profile	Frame Thermal Transmittance (U_f)	Linear Thermal Transmittance (ψ)
Head	1.4 W/m ² K	0.046 W/m.K
Threshold	1.8 W/m ² K	0.046 W/m.K
Jamb	1.4 W/m ² K	0.046 W/m.K
Meeting Stile	1.3 W/m ² K	0.092 W/m.K

3.3 Centre pane U-Value of glazing calculated in accordance with BS EN 673: 2011

Glazing unit	Centre pane U-value (U_g)
Unit thickness = 32.8mm Outer pane = 6.4mm St Gobain Planiclear Cavity = 20mm 90% Argon Inner pane = 6.4mm St Gobain Planitherm One Spacer bar = St Gobain Swisspacer Advance	1.1 W/m ² K

4. U-value calculations



Sample
Style:

**French
Door**

Report Number: U25-008-9 Issue 1.0: 15/01/2025
Report Date: 12 March 2025
Project Details: Lipped French Door

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Input Values:

Yellow input, green intermediary, blue finals X' DP is no. of decimal places to enter

Parameter	Symbol	Units
Total door height ODP	l_d	2725 mm
Total door width ODP	b_d	2500 mm

Frame offset:	No	
Nominal 4mm etc to ODP , others 1DP		
Glazing dimensions and properties:		
Thickness of pane 1	6.4	mm
Pane 1/2 distance	20	mm
Gas fill (1/2)	Argon 90%	
Thickness of pane 2	6.4	mm
Complete next 3 cells for TG IGU		
Pane 2/3 distance		mm
Gas fill (2/3)		
Thickness of pane 3		mm
Glazing Trans. - 3DP	U_g	1.065
g -value - 2DP	g_d	0.46
		W/(m²·K)

Thermal transmittance of door from hot box test		
U_{d-2dp}		W/(m ² ·K)

Door Dimensions:			Area	
Section	Length (m)	Width (m)	No gasket (m ²)	With gasket (m ²)
Left Opening light	2.3490	1.0120	2.3772	2.3745
Right Opening light	2.3490	1.0120	2.3772	2.3745
Total glazing, A_g			4.7544	4.7490
Frame	(m)	(m)	(m ²)	(m ²)
F1	1.2500	0.0800	0.0968	0.0968
F2	1.1700	0.0650	0.0709	0.0713
F3	2.7250	0.0800	0.2123	0.2123
F4	2.5820	0.0650	0.1603	0.1612
F5	1.2500	0.0630	0.0762	0.0762
F6	1.1700	0.1680	0.1833	0.1837
F7	2.5820	0.1860	0.4586	0.4605
F8	1.2500	0.0800	0.0968	0.0968
F9	1.1700	0.0650	0.0709	0.0713
F10	2.7250	0.0800	0.2123	0.2123
F11	2.5820	0.0650	0.1603	0.1612
F12	1.2500	0.0630	0.0762	0.0762
F13	1.1700	0.1680	0.1833	0.1837
Total Frame			2.0581	2.0635
Total door, A_d			6.8125	6.8125
Percentage left light glass area			34.89%	34.86%
Percentage right light glass area			34.89%	34.86%
Percentage glass area (total)			69.79%	69.71%
Solar Factor, g-value:			F_d	0.9
			g_d	0.29

U_{door}	No bars; or attached bars	1.28	W/(m ² ·K)
	Single cross bar in IGU	1.4	
	Multiple cross bar in IGU	1.5	
	Glazing bar (Georgian bar)	1.7	

Frame dimensions: All frame values to nearest 1mm, gaskets to 1DP	Frame heights, (b _i)	Without gasket (mm)	Gasket protrusion (mm)	With gasket (mm)	Total (mm)
F1 + F2 left head rail	F1 left fixed head	80	n/a	80.0	145.4
	F2 left opening head	65	0.4	65.4	
F3 + F4 left jamb	F3 left fixed jamb	80	n/a	80.0	145.4
	F4 left opening jamb	65	0.4	65.4	
F5 + F6 left threshold	F5 left fixed threshold	63	n/a	63.0	231.4
	F6 left opening threshold	168	0.4	168.4	
F7 Meeting Stile	F7 Meeting Stile	186	0.4	186.8	
			0.4		
F8 + F9 right head rail	F8 right fixed head	80	n/a	80.0	145.4
	F9 right opening head	65	0.4	65.4	
F10 + F11 right jamb	F10 right fixed jamb	80	n/a	80.0	145.4
	F11 right opening jamb	65	0.4	65.4	
F12 + F13 right threshold	F12 right fixed threshold	63	n/a	63.0	231.4
	F13 right opening threshold	168	0.4	168.4	
Total gasket area			0.0053763	m ²	

Where a U_d value from hot box testing is available, no L_f^{2D} or L_ψ^{2D} values need to be entered						
Frame conductance:		All L values to 4DP . All b values to ODP				
		$W/(m \cdot K)$	b_g (mm)		$W/(m \cdot K)$	b_g (mm)
F1 + F2 left head rail	L_f^{2D}	0.3713	190	L_ψ^{2D}	0.4476	190
F3 + F4 left jamb		0.3710	190		0.4473	190
F5 + F6 left threshold		0.5822	190		0.6588	190
F7 Meeting Stile		0.5882	380		0.7414	380
F8 + F9 right head rail		0.3713	190		0.4476	190
F10 + F11 right jamb		0.3710	190		0.4473	190
F12 + F13 right threshold		0.5822	190		0.6588	190

Frame:	Frame width, b_i	Frame U-value, U_i	Frame area (no gaskets), A_i	Frame heat flow, H_{U_i}	Linear trans., ψ	Linear length, l_g	Junction heat flow, H_{ψ}
Section	(m)	(W/(m ² ·K))	(m ²)	(W/K)	(W/(m·K))	(m)	(W/K)
F1 + F2 left head rail	0.1450	1.3772	0.1677	0.2310	0.0456	1.0120	0.0461
F3 + F4 left jamb	0.1450	1.3751	0.3725	0.5123	0.0456	2.3490	0.1070
F5 + F6 left threshold	0.2310	1.7774	0.2595	0.4613	0.0459	1.0120	0.0464
F7 Meeting Stile	0.1860	1.3171	0.4586	0.6040	0.0917	2.3490	0.2155
F8 + F9 right head rail	0.1450	1.3772	0.1677	0.2310	0.0456	1.0120	0.0461
F10 + F11 right jamb	0.1450	1.3751	0.3725	0.5123	0.0456	2.3490	0.1070
F12 + F13 right threshold	0.2310	1.7774	0.2595	0.4613	0.0459	1.0120	0.0464
Totals		2.0581	3.0130		Total		0.6146

Other parameters needed for calculation, taken from simulations:					
$\lambda_p = 0.035$ W/(m·K)	$R_{se} = 0.04$ m ² ·K/W	$R_{se} = 0.13$ m ² ·K/W	$d_p = d_g = 0.0328$ m	$R_p = 0.9371$ m ² ·K/W	$U_p = 0.9032$ W/(m ² ·K)

Thermal transmittance, W/(m ² ·K)	U_{door}	1.3
Solar factor	g_{door}	0.29

BFRC Certified
Simulator No



Simulator Name: Sue Peatey

S166

Figure 1. Cross section drawing, including dimensions, of door.

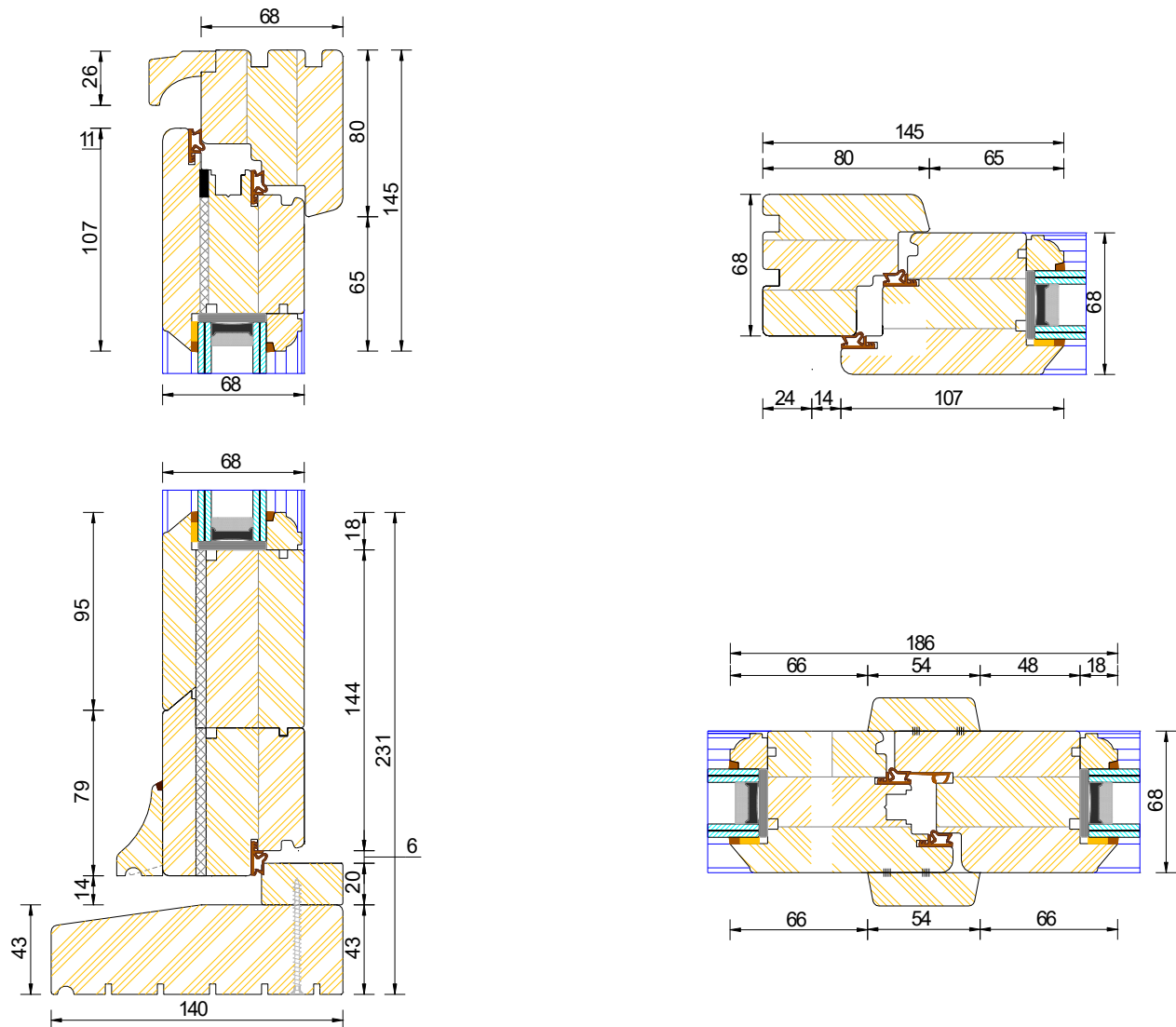


Figure 2. Simulation of head profile

External Environment

R_{si} Normal = $0.04 \text{ m}^2\text{K/W}$

R_{si} Reduced = $0.04 \text{ m}^2\text{K/W}$

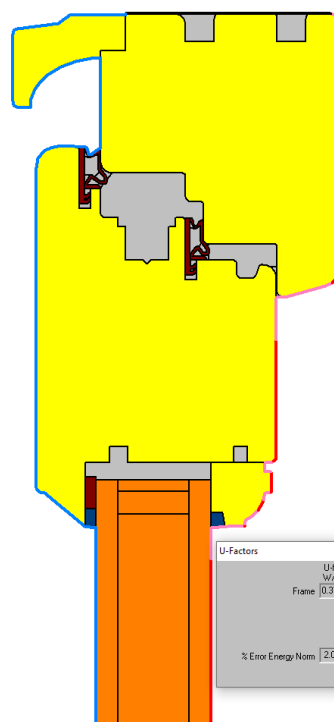
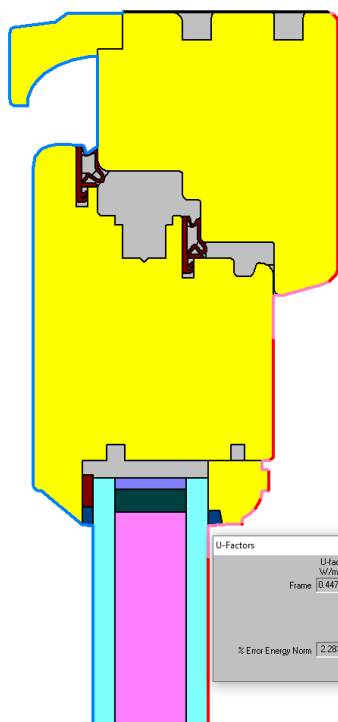
Temperature = 0°C

Internal Environment

R_{si} Normal = $0.13 \text{ m}^2\text{K/W}$

R_{si} Reduced = $0.20 \text{ m}^2\text{K/W}$

Temperature = 20°C



Quad Tree Mesh Parameter 9

Figure 3. Simulation of threshold profile.

External Environment

R_{si} Normal = $0.04 \text{ m}^2\text{K/W}$

R_{si} Reduced = $0.04 \text{ m}^2\text{K/W}$

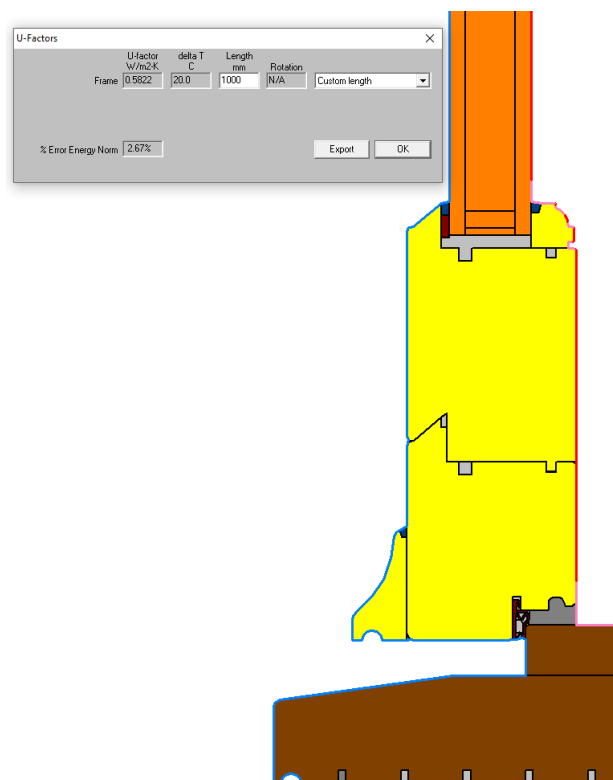
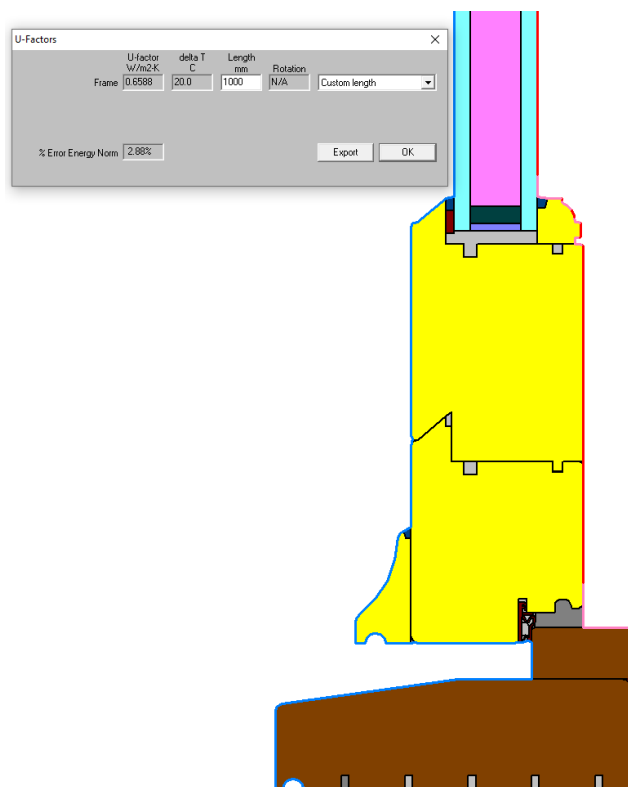
Temperature = 0°C

Internal Environment

R_{si} Normal = $0.13 \text{ m}^2\text{K/W}$

R_{si} Reduced = $0.20 \text{ m}^2\text{K/W}$

Temperature = 20°C



Quad Tree Mesh Parameter 9

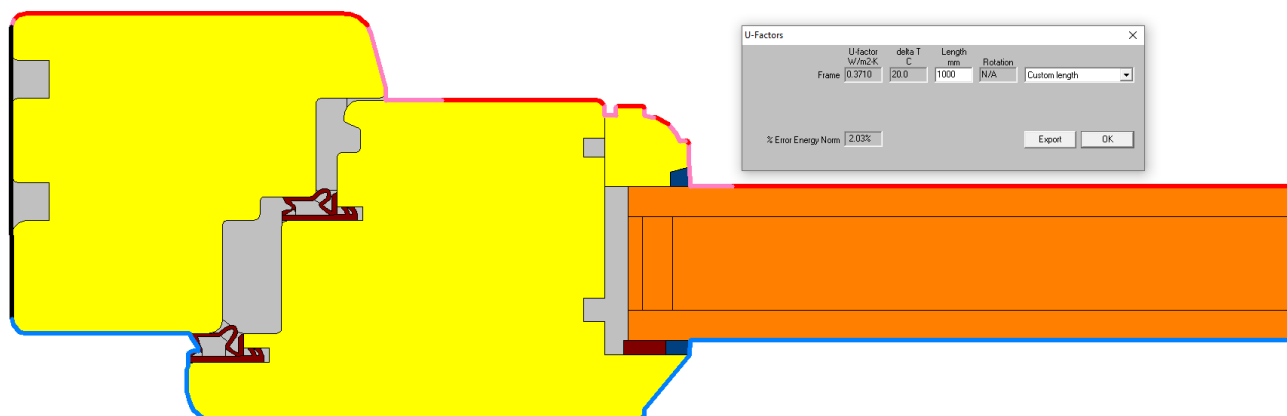
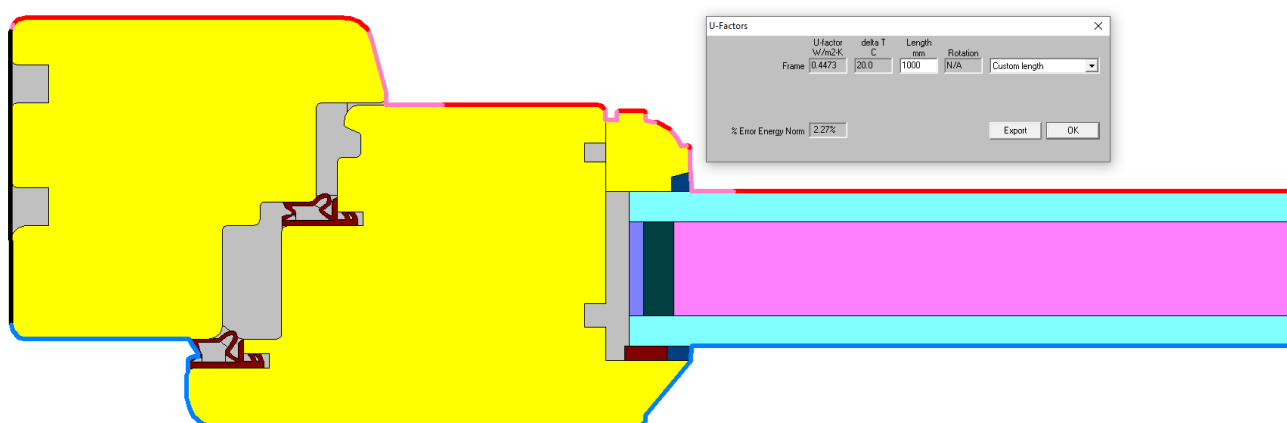
Figure 4. Simulation of jamb profile.

Internal Environment

R_{si} Normal = $0.13 \text{ m}^2\text{K/W}$

R_{si} Reduced = $0.20 \text{ m}^2\text{K/W}$

Temperature = 20°C



External Environment

R_{si} Normal = $0.04 \text{ m}^2\text{K/W}$

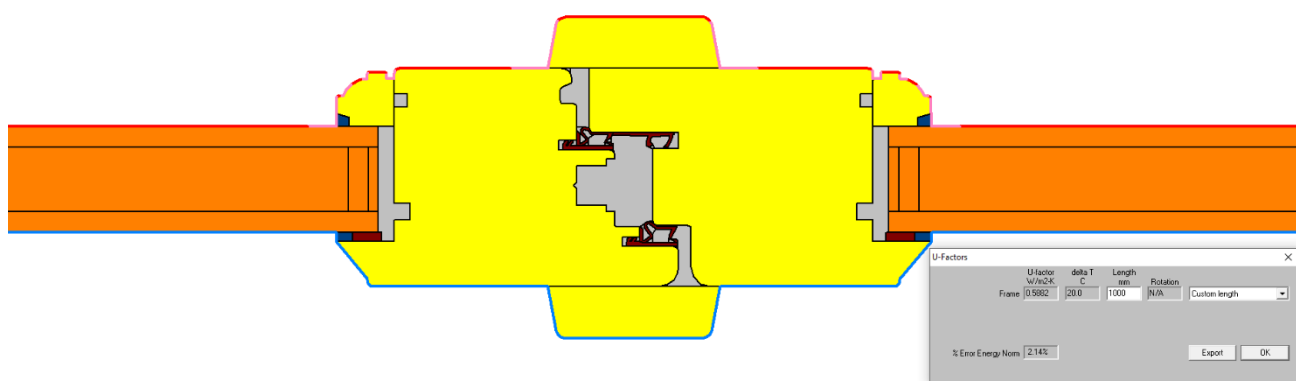
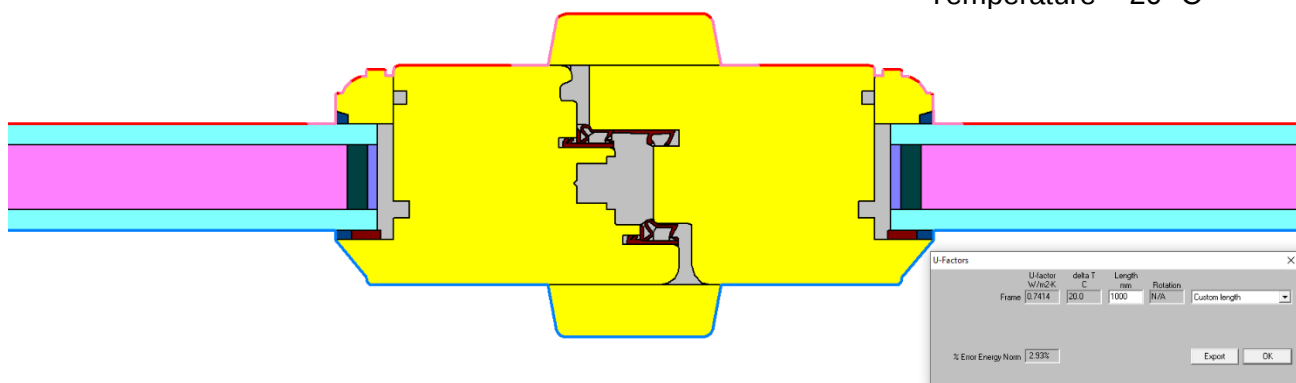
R_{si} Reduced = $0.04 \text{ m}^2\text{K/W}$

Temperature = 0°C

Quad Tree Mesh Parameter 9

Figure 5. Simulation of meeting stile profile.

Internal Environment
 R_{si} Normal = $0.13 \text{ m}^2\text{K/W}$
 R_{si} Reduced = $0.20 \text{ m}^2\text{K/W}$
Temperature = 20°C



External Environment
 R_{se} Normal = $0.04 \text{ m}^2\text{K/W}$
 R_{se} Reduced = $0.04 \text{ m}^2\text{K/W}$
Temperature = 0°C

Quad Tree Mesh Parameter 9

Key To Figures

	Material	Thermal Conductivity W/(m.K)	Source
	Softwood	0.13	Annex D of BS 10077-2
	Hardwood	0.18	Annex D of BS 10077-2
	Soda Lime Glass	1.0	Annex D of BS 10077-2
	EPDM	0.25	Annex D of BS 10077-2
	Swisspacer Advance	0.29	BF Datasheet W24 (see page 13)
	Polysulfide/Polyurethane	0.4	Annex D of BS 10077-2
	Silicone	0.35	Annex D of BS 10077-2
	Polyurethane foam	0.05	Table 3 of BS 10456
	Insulation panel	0.035	Annex D of BS 10077-2

Glazing unit 6.4-20-6.4 Low E 0.01 uncorrected 90% argon 10% air filled

BTF 01 Issue 0, September 2023. Calculations according to BS EN 673:2011

Number of spaces		1	
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Glazing orientation		Vertical	
Resistivity panes	1	m·K/W	

Outside		Spaces 1	
Calculate	Thickness (mm)	6.4	20
	Normal emissivity	0.89	0.01
	$\sum d_j \cdot r_j =$	0.0128	
	Uncoated		

External, R_{se}	0.04	(m ² ·K)/W
Internal, R_{si}	0.13	(m ² ·K)/W

Iteration number	U value	$\sum 1/h_s$
	W/(m ² ·K)	(m ² ·K)/W
1	1.065	0.75659
2	1.065	0.75659

λ_{eff}	ΔT
W/(mK)	
0.0264	15
0.0264	15

G-Value Data



33.1 (20 Argon 90) 33.1

Coating: PLANITHERM ONE T FG #5

Computed by: Sue Peatey

Computed on: 03/03/2025

Product catalog: United Kingdom

Norms: EN410:2011

Glazing type



**Glazing 1**
PLANICLEAR (3mm) - Annealed
PVB STANDARD (0.38mm)
PLANICLEAR (3mm) - Annealed

**Cavity 1**
Argon 90% 20 mm

**Glazing 2**
PLANITHERM ONE T FG
PLANICLEAR (3mm) - Annealed
PVB STANDARD (0.38mm)
PLANICLEAR (3mm) - Annealed

Simulated performance datas

 Luminous Factors	CIE015:2018
Light Transmittance (TL)	66%
Outdoor Reflectance (RLe)	25%
Indoor Reflectance (RLi)	25%
 Energy Factors	EN410:2011
Transmittance (TE)	39%
Outdoor Reflectance (Ree)	37%
Indoor Reflectance (Rel)	35%
Absorptance A1 (AE1)	17%
Absorptance A2 (AE2)	7%
 Solar Factors	EN410:2011
Solar Factor (g)	0.46
Shading Coefficient (SC)	0.53
 Thermal Transmission	EN673:2011
Ug	1.1 W/(m2.K)
Angle relative to the vertical	0°
 Acoustics	EN 12758
<i>Acoustic simulated values</i>	
Rw (C;Ctr)	37 (-3; -7) dB
Ra	34 dB
Ra,tr	30 dB
STC (ASTM E413)	37
OITC (ASTM E1332)	26
 Color Rendering	CIE015:2018
Transmission (Ra)	96.5
Reflection (Ra)	95.8
 Safety Class	EN12600
Pendulum Body Resistance	2B2/2B2
 Anti-Burglary	EN356
Burglar Resistance	NPD
 Manufacturing Sizes	
Nominal Thickness	32.8 mm
Weight	31 kg/m²
 Sustainability	
Carbon footprint	
<i>The value is calculated regarding the composition computed based on the standard EN 15804+A2 (2019)</i>	
Global Warming Potential (GWP) – A1-A3	EN 15804+A2 (2019)
(kg, CO ₂ eq./m²) European average	54

Conductivity of Spacer

August 2014 – No. W24 – Revision index 7-01/2025 – valid until June 30th, 2025

'WARM EDGE' WORKING PARTY

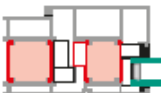
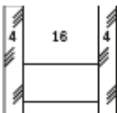
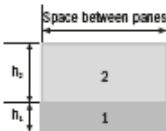


Data sheet Psi values for windows

based on determination of the equivalent thermal conductivity of spacers by measurement



SWISSPACER
Vetrotech Saint-Gobain (International) AG
Industriestrasse 8
CH-8574 Lengwil

	Product name	Spacer height in mm		Material	Thickness d in mm
Profile description		6.5	Spacer category C	Thermally improved aluminium foil / SAN-GF	- 0.02
					1.0
Representative frame profiles	Representative glass constructions	Metal with thermal break	Plastic	Wood	Wood/Metal
					
	 Double-sheet insulating glass $U_g=1.1 \text{ W/m}^2\text{K}$	0.047	0.039	0.039	0.042
Representative psi value double-sheet thermally insulating glass W/mK	 Triple-sheet insulating glass $U_g=0.7 \text{ W/m}^2\text{K}$	0.042	0.037	0.037	0.040
Two Box model Characteristic values		Space between panes in mm		$\lambda_{eq,2B}$ in W/mK	
				Box 1 · $h_1 = 3 \text{ mm}$	Box 2 · $h_2 = 6.5 \text{ mm}$
		Can be used for all spacer widths		0.40	0.29

The equivalent thermal conductivity has been determined in accordance with the ift guideline WA-17engl/ 1 "Thermally improved spacers - Determination of the equivalent thermal conductivity by measurement". The representative linear heat transfer coefficients calculated in this way (representative psi values) apply to typical frame profiles and glazing for the determination of the heat transfer coefficient U_w of windows. They have been determined under the boundary conditions (frame profiles, glazing, glass mounting depth, back covering, primary and secondary sealant) defined in the ift guideline WA-08engl/3 "Thermally improved spacers - Part 1: Determination of the representative Psi value for window frame profiles". This guideline also governs the area of validity and application of the representative psi values. In order to avoid rounding errors, the psi values in the data sheet have been given at 0.001 W/mK. The method for the arithmetical determination of the psi values has an accuracy of $\pm 0.003 \text{ W/mK}$. Differences of less than 0.005 W/mK are not significant. For further information, refer to the Bulletin 004/2008 "Guide to Warm Edge" of Bundesverband Flachglas.

Characteristic values determined by:

