

Calculation for Thermal Transmittance of PVCU Windows
In Accordance with
BS EN ISO 10077-2:2003
U Value Simulation by Physibel Bisco 10.0w

Client
Eclectic Systems LLP
Unit 8
Quadrant Business Centre
Davy Way
Hardwicke
Gloucester
GL2 2RN

Date
2nd July 2016

Report
R9_075

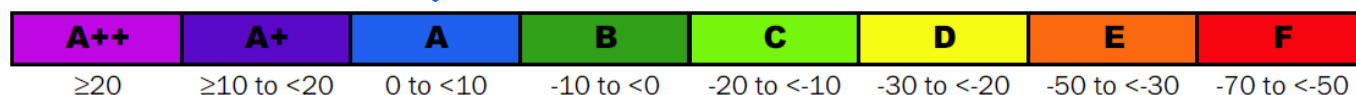
Door Profile
R7 Frame, Open Out Flush sash
Double Door

Insulated Glazing Unit
28mm unit size
4·20·4 configuration
4mm Planiclear · 20mm Argon (90%) · 4mm Planitherm Total+

Spacer Bar
Swisspacer Ultimate

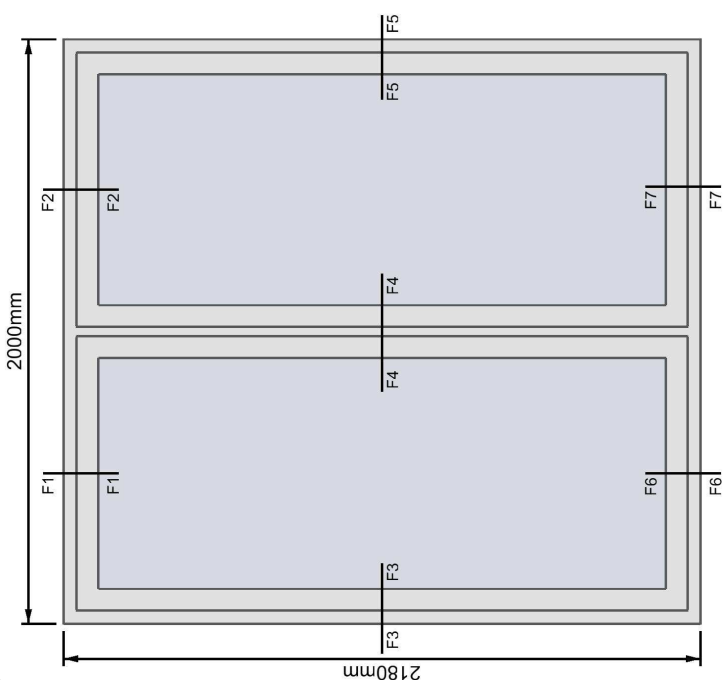
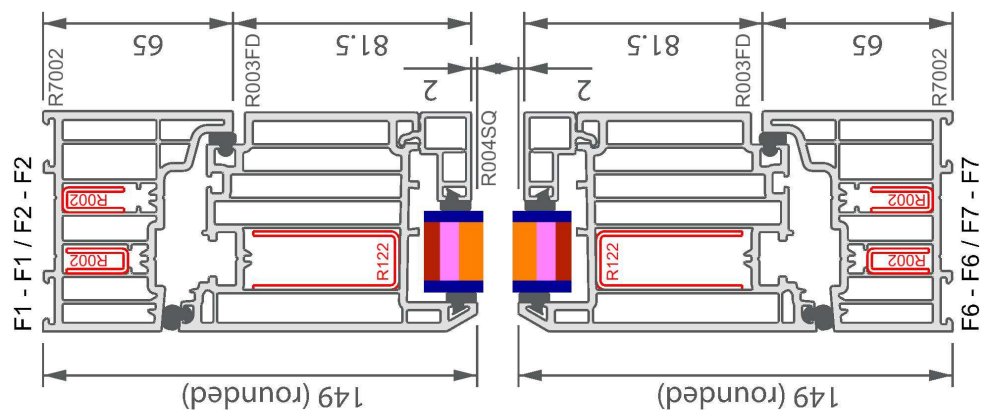
Simulation Result Summary

Window U Value	Window g Value	L Factor	Energy Rating	Label Index
1.23	0.41	0.07	0.58	1



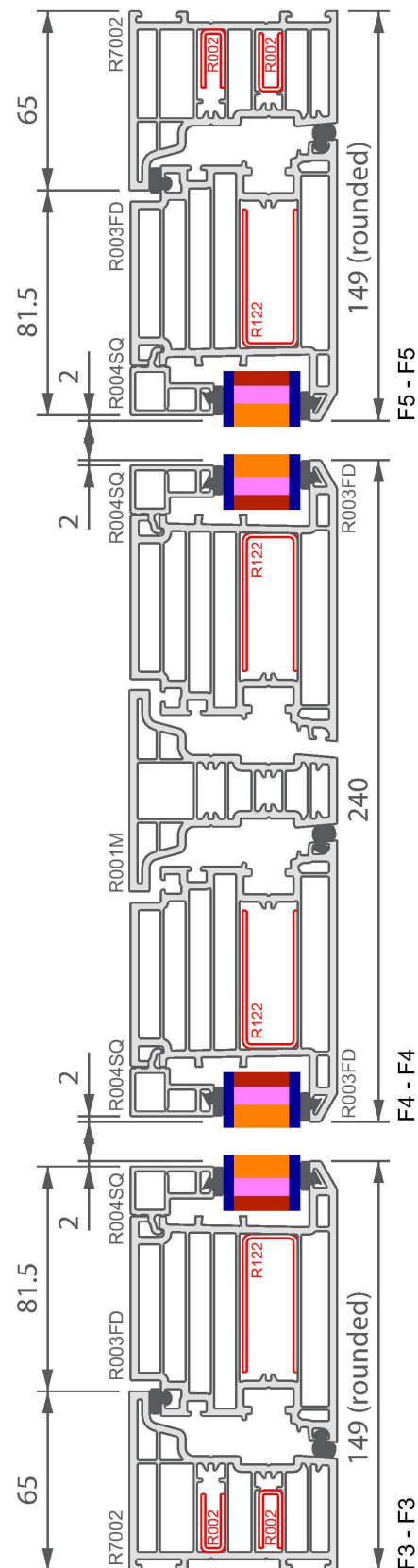
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Door Profile



R7

Open Out
Double Door
Flush Sash
Double Glazed





CERTIFIED SIMULATOR
No. 039



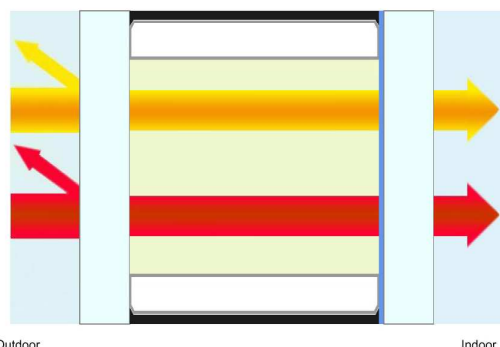
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Glass Unit Specification

Calumen® II 1.3.0
05 December 2014
Data base : SGG UK



Glazing design



	First glazing	Second glazing
Gas		Argon 90% 20.00mm
Coating		PLANITHERM TOTAL+
First glass	PLANICLEAR 4.00mm	PLANICLEAR 4.00mm
Coating		
Layer		
Coating		
Second glass		
Coating		

Manufacturing sizes

Nominal thickness : **28.0 mm**
Weight : **20.0 kg/m²**

Luminous factors (EN410-2011)

Transmittance : **81 %**
Outdoor reflectance : **12 %**
Indoor reflectance : **13 %**

Energy factors (EN410-2011)

Transmittance : **64 %**
Outdoor reflectance : **20 %**
Indoor reflectance : **20 %**
Absorptance A1 : **6 %**
Absorptance A2 : **9 %**

Solar factors (EN410-2011)

g : **0.73**
Shading coefficient : **0.83**

Thermal transmission (EN673-2011) - 0° related to vertical position

Ug : **1.2 W/(m².K)**



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CALUMEN® II is a simulation software to calculate key performance of glass such as light transmission, solar factor or thermal insulation coefficient. Computed values are indicative and subject to change. They can not be used to guarantee performance of the products.

These values are calculated according to EN410-2011 and EN673-2011 standards. Tolerances are defined according to EN 1096-4 or ISO9050 standards. Nevertheless, user must check the feasibility of the associated products, in particular in terms of thickness and colour. Furthermore, it is his responsibility to check that the resulting combination of glazing meets regulatory requirements at national, local or regional level.

Calculation rules and functional output of Calumen II have been validated by TÜV Rheinland Quality Report 11923R-11-33705



• Calculation software
verified
• EN 410 and EN 673

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Glass Unit Specification (cont...)

Version 12 18/06/2015. Calculations according to BS EN 673:2011

Number of spaces		1	
Glazing orientation		Vertical	
Resistivity panes	1	m·K/W	
Outside		Spaces 1	
		P a n e 1	P a n e 2
		90%	
		Gas	
		Argon	
Thickness (mm)	4.0	20	4.0
Normal emissivity		0.89	0.05
$\sum d_j \cdot r_j =$	0.008	Uncoated	

For uncoated surfaces input 0.89 for normal emissivity, which corresponds to a corrected emissivity of 0.837

External, R_{se}	0.04	$(m^2 \cdot K)/W$
Internal, R_{si}	0.13	$(m^2 \cdot K)/W$
Iteration number	U value	$\sum 1/h_s$
	$W/(m^2 \cdot K)$	$(m^2 \cdot K)/W$
1	1.219	0.64228
2	1.219	0.64228

λ_{eff}	ΔT
$W/(mK)$	
0.0311	15
0.0311	15

Spacer Bar Datasheet

April 2013 – No.19 – Revision index 0

'WARM EDGE' WORKING PARTY



Data sheet Psi values for windows

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

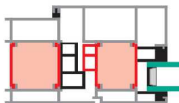
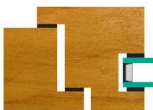
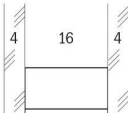
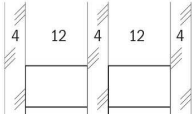
SWISSPACER®

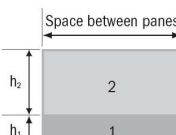
Vetrotech Saint-Gobain (International) AG
Zweigniederlassung Kreuzlingen
Sonnenwiesenstrasse 15
CH-8280 Kreuzlingen

SWISSPACER®



	Product name	Spacer height in mm	Material	Thickness d in mm
Cross-section	 Ultimate SWISSPACER	6.5	Plastic / Multilayer – polyester coated film "High Tech Gas Barrier Foil"	1.0 0.097

		Metal with thermal break	Plastic	Wood	Wood / Metal
Representative frame profile					
Representative psi value double-sheet thermally insulating glass W/mK	 Double-sheet insulating glass $U_g = 1.1 \text{ W/m}^2\text{K}$	0.036	0.032	0.031	0.032
Representative psi value triple-sheet thermally insulating glass W/mK	 Triple-sheet insulating glass $U_g = 0.7 \text{ W/m}^2\text{K}$	0.031	0.030	0.029	0.030

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	0.14

Explanations

The equivalent thermal conductivity has been determined in accordance with the ift guideline WA-17/1 "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 UW 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-08/2 "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 "Compass 'Warm Edge' for Windows" of Bundesverband Flachglas.

Ermittlung der Kennwerte durch:

Hochschule **Rosenheim**
University of Applied Sciences





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R9_075

Air Permeability Test Results
BS 6375-1:2015 / BS EN 1026:2000
Exova Warringtonfire Test Report No. WIL363356
Report Date 3rd May 2016

Test Pressure (Pa)	Air permeability per unit length			
	Positive (m ³ /h.m)	Negative (m ³ /h.m)	Average (m ³ /h.m)	Simulation it relates to
50	1.56	2.22	1.89	R9_075
100	2.36	3.43	2.89	
150	2.92	4.44	3.68	
200	3.36	5.27	4.31	
250	3.72	6.02	4.87	
300	4.09	6.68	5.38	
450	4.92	8.78	6.82	
600	5.54	10.49	8.01	



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Component Material Specifications

Component	Material	Thermal Conductivity (W/mK)	Authority	Simulation it relates to
Framing	PVCU	0.17	EN 12524	R9_075
Glazing bead	PVCU	0.17	EN 12524	
Reinforcement	Steel	0.50	EN 12524	
Gasket/weatherseal	Q-lon	0.06	Manufacturers stated value	
Glass	Saint Gobain	1.00	EN 12524	

Spacer bar

Swisspacer Ultimate	Plastic/multi-layer polyester coated film	0.14	WA-17/1 BF datasheet 19	R9_075
Secondary seal Depth 3.0mm	Butyl	0.24	EN 12524	

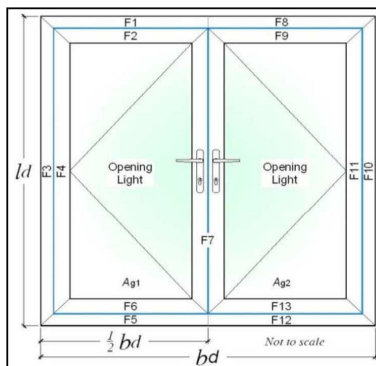


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R9_075

Calculation Spreadsheet



Sample
Style:
**French
Door**

Report Number: **R9_075** Issue 2.5: 16/11/2015
Report Date: **4th April 2016**
Project Details: **R7/R3FD/R1M/R4_SQ4mmPlaniclear_20mmArgon_4mmTotal+ with Swiss Ultimate (3.0mm Butyl)**

THIS SPREADSHEET IS THE PROPERTY OF THE BFRC AND CAN ONLY BE USED IN CONJUNCTION WITH A BFRC LICENCE APPLICATION

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	2180 mm
Total door width ODP	b_d	2000 mm

Frame offset: **Yes**

Nominal 4mm etc to ODP , others 1DP			
Glazing dimensions and properties:			
Thickness of pane 1	4	mm	
Pane 1/2 distance	20	mm	
Gas fill (1/2)	Argon 90%		
Thickness of pane 2	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	1.219	W/(m ² ·K)
g-value - 2DP	g_d	0.73	

Thermal transmittance of door from hot box test
 U_{d-2dp} **W/(m²·K)**

Door Dimensions:			Area	
Section	Length (m)	Width (m)	No gasket (m ²)	With gasket (m ²)
Left Opening light	1.8820	0.7310	1.3757	1.3757
Right Opening light	1.8820	0.7310	1.3757	1.3757
Total glazing, A_g			2.7515	2.7515
Frame	(m)	(m)	(m ²)	(m ²)
F1	1.0000	0.0650	0.0629	0.0629
F2	0.9350	0.0840	0.0700	0.0700
F3	2.1800	0.0650	0.1375	0.1375
F4	2.0500	0.0840	0.1651	0.1651
F5	1.0000	0.0650	0.0629	0.0629
F6	0.9350	0.0840	0.0700	0.0700
F7	2.0500	0.2400	0.4718	0.4718
F8	1.0000	0.0650	0.0629	0.0629
F9	0.9350	0.0840	0.0700	0.0700
F10	2.1800	0.0650	0.1375	0.1375
F11	2.0500	0.0840	0.1651	0.1651
F12	1.0000	0.0650	0.0629	0.0629
F13	0.9350	0.0840	0.0700	0.0700
Total Frame			1.6085	1.6085
Total door, A_d			4.3600	4.3600
Percentage left light glass area			31.55%	31.55%
Percentage right light glass area			31.55%	31.55%
Percentage glass area (total)			63.11%	63.11%
Solar Factor, g-value:			F_d	0.9
			g_d	0.41

U_{door}	No bars; or attached bars	1.23	$W/(m^2 \cdot K)$
	Single cross bar in IGU	1.3	
	Multiple cross bar in IGU	1.4	
	Glazing bar (Georgian bar)	1.6	

Energy Door Energy Index	BFRC Rating kWh/(m ² ·yr)
1	≥ 20 A++
	>10 to 20 A+
Door Rating	0 to <10 A
A	-10 to <0 B
	-20 to <-10 C
	-30 to <-20 D
	-50 to <-30 E

Frame dimensions: All frame values to nearest 1mm, gaskets to 1DP	Frame heights, (b _f)	Without gasket (mm)	Frame offset	Gasket protrusion (mm)	With gasket (mm)	Total (mm)
F1 + F2 left head rail	F1 left fixed head	65	n/a	n/a	65.0	149.0
	F2 left opening head	84	2	0.0	84.0	
F3 + F4 left jamb	F3 left fixed jamb	65	n/a	n/a	65.0	149.0
	F4 left opening jamb	84	2	0.0	84.0	
F5 + F6 left threshold	F5 left fixed threshold	65	n/a	n/a	65.0	149.0
	F6 left opening threshold	84	2	0.0	84.0	
F7 Meeting Stile	F7 Meeting Stile	240	2	0.0	240.0	
F8 + F9 right head rail	F8 right fixed head	65	n/a	n/a	65.0	149.0
	F9 right opening head	84	2	0.0	84.0	
F10 + F11 right jamb	F10 right fixed jamb	65	n/a	n/a	65.0	149.0
	F11 right opening jamb	84	2	0.0	84.0	
F12 + F13 right threshold	F12 right fixed threshold	65	n/a	n/a	65.0	149.0
	F13 right opening threshold	84	2	0.0	84.0	
Total gasket area						0 m ²

Where a U_g value from hot box testing is available, no L_{f-20} or $L_{\psi-20}$ values need to be entered						
Frame conductance:		All L values to 4DP . All b values to ODP				
		W/(m·K)	b_f (mm)		W/(m·K)	b_{ψ} (mm)
F1 + F2 left head rail	L_{f-20}	0.3707	200	$L_{\psi-20}$	0.4300	200
F3 + F4 left jamb		0.3707	200		0.4300	200
F5 + F6 left threshold		0.3707	200		0.4300	200
F7 Meeting Stile		0.6856	400		0.8043	400
F8 + F9 right head rail		0.3707	200		0.4300	200
F10 + F11 right jamb		0.3707	200		0.4300	200
F12 + F13 right threshold		0.3707	200		0.4300	200

Frame:	Frame width, b _f	Frame U-value, U _f	Frame area (no gaskets), A _f	Frame heat flow, H _f	Linear trans, ψ	Linear length, l _g	Junction heat flow, H _ψ
	(m)	(W/(m ² ·K))	(m ²)	(W/K)	(W/(m·K))	(m)	(W/K)
F1 + F2 left head rail	0.1490	1.1041	0.1329	0.1467	0.0217	0.7350	0.0159
F3 + F4 left jamb	0.1490	1.1041	0.3026	0.3341	0.0217	1.8860	0.0409
F5 + F6 left threshold	0.1490	1.1041	0.1329	0.1467	0.0217	0.7350	0.0159
F7 Meeting Stile	0.2400	1.1385	0.4718	0.5372	0.0435	1.8860	0.0820
F8 + F9 right head rail	0.1490	1.1041	0.1329	0.1467	0.0217	0.7350	0.0159
F10 + F11 right jamb	0.1490	1.1041	0.3026	0.3341	0.0217	1.8860	0.0409
F12 + F13 right threshold	0.1490	1.1041	0.1329	0.1467	0.0217	0.7350	0.0159
Totals		1.6085	1.7922		Total	0.2275	

Other parameters needed for calculation, taken from simulations:
 $\lambda_p = 0.035$ W/(m·K) $R_{se} = 0.04$ m²·K/W $d_p = d_g = 0.028$ m
 $R_p = 0.8000$ m²·K/W $R_{tot} = 0.9700$ m²·K/W $R_{se} = 0.13$ m²·K/W
 $U_p = 1.0309$ W/(m²·K)

Air Leakage loss:			
Air leakage at 50 Pa per hour & per unit length of opening light (BS 6375-1) - 2DP			
Opening light length	9.8900 m	Total air leakage	18.692 m ³ /h
L_{50}	4.29 m ³ /(m ² ·h)	Heat loss = 0.0165 L_{50}	0.07 W/(m ² ·K)

BFRC Rating =		0.58
218.6g _d - 68.5 x (U _d + Effective L ₅₀) =		
Climate zone is:		UK
Thermal transmittance, W/(m ² ·K)	U_{door}	1.2
Solar factor	g_{door}	0.41
Door air leakage heat loss, W/(m ² ·K)	L_{factor}	0.07

Simulator Name: **M Castle**



Signed...

[Signature]

BFRC Certified
Simulator No

039

M. Castle