CERTIFIED SIMULATOR
No. 039

RESIDENCE 9

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_099

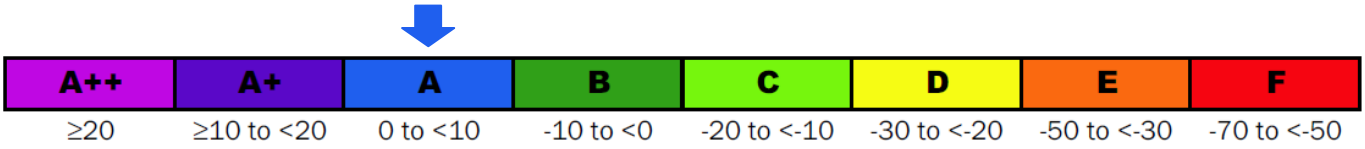
Door Profile
R2 Frame, Open In
Double Door

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
1.19	0.41	0.07	3.32	3



Mark Castle
T. 01249 810415 F. 01249 815234
mark.castle@deceuninck.com

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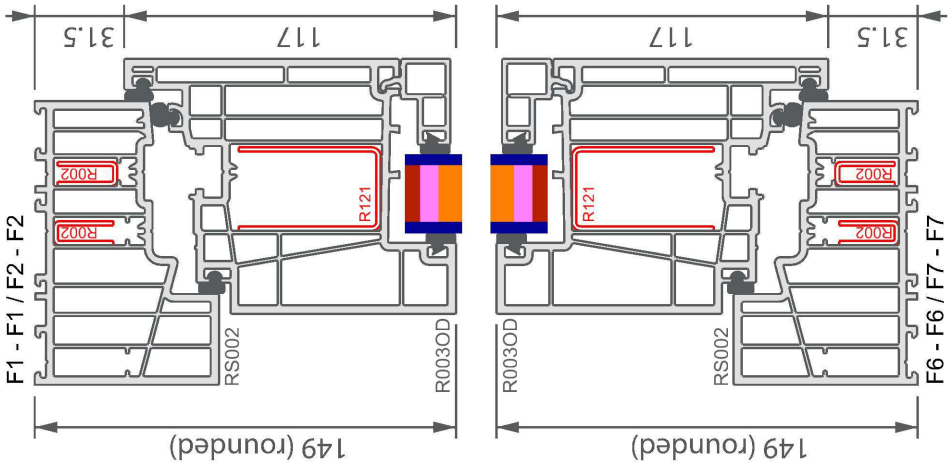
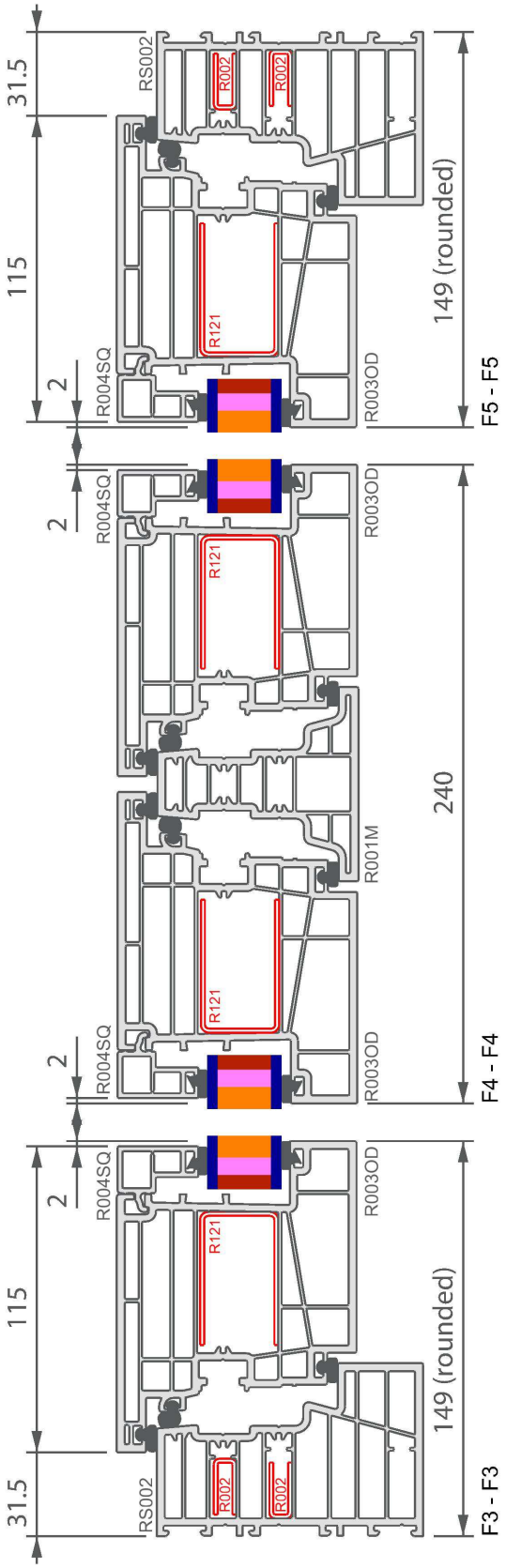
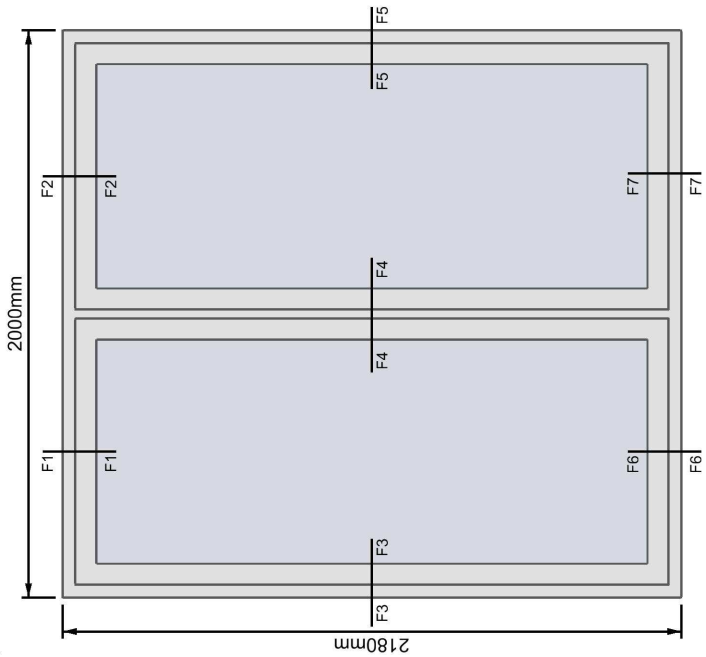
Door Profile







R2

Open In
Double Door
Double Glazed

Mark Castle
T. 01249 810415 F. 01249 815234
mark.castle@deceuninck.com

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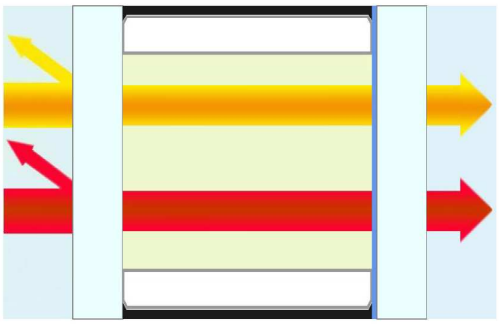
Glass Unit Specification

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

SAINT-GOBAIN

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)**

Calumen II

Toby Blamey
BFRC
BFRC
54 Ayres Street
SE1 1EU
London

Phone : 020 7403 9200
Mobile : 1234556778
Fax :
tblamey@bfrc.org

Mark Castle
T. 01249 810415 F. 01249 815234
mark.castle@deceuninck.com

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Glass Unit Specification (cont…)

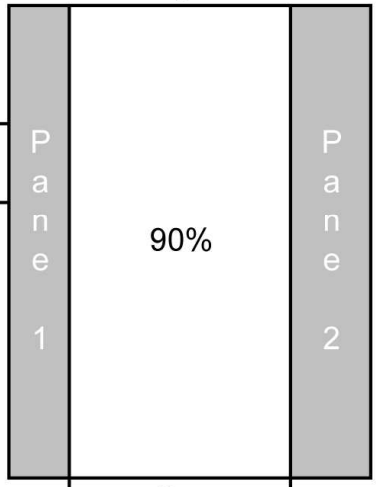
Version 12 18/06/2015. Calculations according to BS EN 673:2011

Number of spaces
1

Spaces 1

Glazing orientation		
	Vertical	
Resistivity panes	1	m·K/W

Outside



		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	$\sum 1/h_s$	λeff	ΔT
	W/(m²·K)	(m²·K)/W	W/(mK)	
1	1.219	0.64228	0.0311	15
2	1.219	0.64228	0.0311	15

Mark Castle
T. 01249 810415 F. 01249 815234
mark.castle@deceuninck.com

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R9_099

Spacer Bar Datasheet

April 2013 – No.19 – Revision index 0

'WARM EDGE' WORKING PARTY

BF

RAL GÜTEZEICHEN MEHRSCHEIBEN ISOLIERGLAS

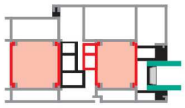
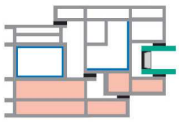
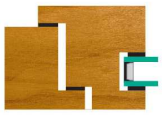
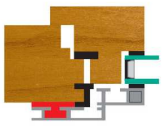
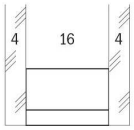
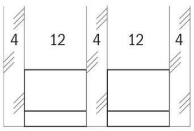
Data sheet Psi values for windows

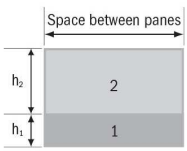
based on determination of the equivalent thermal conductivity of spacers by measurement

SWISSPACER®

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

	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 W/m²K	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 W/m²K	0.031	0.030	0.029	0.030

		Space between panes in mm	$\lambda_{eq,2B}$ in W/mK	
			Box 1 · h_1 = 3 mm	Box 2 · h_2 = 6.5 mm
Two Box model Characteristic values		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 ± 0.003 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
ift ROSENHEIM

Mark Castle
T. 01249 810415 F. 01249 815234
mark.castle@deceuninck.com

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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_099
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_099
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_099
Secondary seal Depth 3.0mm	Butyl	0.24	EN 12524	

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T. 01249 810415 F. 01249 815234
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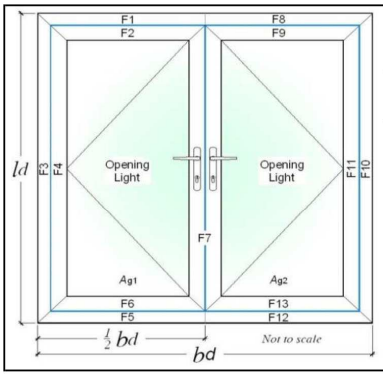
Calculation Spreadsheet



Sample Style: **French Door**

Blue line illustrates opening light length (air leakage)

Report Number: R9_099 Issue 2.5: *16/11/2015*
Report Date: 4th April 2016
Project Details: RS2/R3OD/R1M/R4SQ_4mmPlaniclear_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 ***0DP***	l_d	2180	mm
Total door width ***0DP***	b_d	2000	mm

Frame offset: **Yes**

Nominal 4mm etc to ***0DP***, 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/(m²·K)
g -value - ***2DP***	$g_\perp$	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	0.0320	0.0315	0.0315
F2	0.9680	0.1170	0.0994	0.0994
F3	2.1800	0.0320	0.0687	0.0687
F4	2.1160	0.1170	0.2339	0.2339
F5	1.0000	0.0320	0.0315	0.0315
F6	0.9680	0.1170	0.0994	0.0994
F7	2.1160	0.2400	0.4798	0.4798
F8	1.0000	0.0320	0.0315	0.0315
F9	0.9680	0.1170	0.0994	0.0994
F10	2.1800	0.0320	0.0687	0.0687
F11	2.1160	0.1170	0.2339	0.2339
F12	1.0000	0.0320	0.0315	0.0315
F13	0.9680	0.1170	0.0994	0.0994
Total Frame			1.6085	1.6085
Total door, A_u			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	1.19	W/(m²·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
3
Door Rating
A

BFRC Rating
kWh/(m²·yr)
≥ 20 A ++
>10 to 20 A +
0 to <80 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	32	n/a	n/a	32.0	149.0
	F2 left opening head	117	2	0.0	117.0	
F3 + F4 left jamb	F3 left fixed jamb	32	n/a	n/a	32.0	149.0
	F4 left opening jamb	117	2	0.0	117.0	
F5 +F6 left threshold	F5 left fixed threshold	32		n/a	32.0	149.0
	F6 left opening threshold	117	2	0.0	117.0	
F7 Meeting Stile	F7 Meeting Stile	240	2	0.0	240.0	
			2	0.0		
F8 + F9 right head rail	F8 right fixed head	32	n/a	n/a	32.0	149.0
	F9 right opening head	117	2	0.0	117.0	
F10 + F11 right jamb	F10 right fixed jamb	32	n/a	n/a	32.0	149.0
	F11 right opening jamb	117	2	0.0	117.0	
F12 + F13 right threshold	F12 right fixed threshold	32	n/a	n/a	32.0	149.0
	F13 right opening threshold	117	2	0.0	117.0	
		Total gasket area		0		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 ***0DP***				
		W/(m·K)	b_f (mm)		W/(m·K)	b_g (mm)
F1 + F2 left head rail	L_f^{2D}	**0.3530**	**200**	L_ψ^{2D}	**0.4127**	**200**
F3 + F4 left jamb		**0.3530**	200		**0.4127**	200
F5 +F6 left threshold		**0.3530**	200		**0.4127**	200
F7 Meeting Stile		**0.6639**	400		**0.7828**	400
F8 + F9 right head rail		**0.3530**	200		**0.4127**	200
F10 + F11 right jamb		**0.3530**	200		**0.4127**	200
F12 + F13 right threshold		**0.3530**	200		**0.4127**	200

Frame: Section	Frame width, b_f (m)	Frame U-value, U_f (W/(m²·K))	Frame ares (no gaskets), A_f (m^2)	Frame heat flow, HU (W/K)	Linear trans, ψ (W/(m·K))	Linear length, l_g (m)	Junction heat flow, Hψ (W/K)
F1 + F2 left head rail	0.1490	0.9853	0.1309	0.1290	0.0221	0.7350	0.0162
F3 + F4 left jamb	0.1490	0.9853	0.3026	0.2982	0.0221	1.8860	0.0417
F5 +F6 left threshold	0.1490	0.9853	0.1309	0.1290	0.0221	0.7350	0.0162
F7 Meeting Stile	0.2400	1.0480	0.4798	0.5028	0.0437	1.8860	0.0824
F8 + F9 right head rail	0.1490	0.9853	0.1309	0.1290	0.0221	0.7350	0.0162
F10 + F11 right jamb	0.1490	0.9853	0.3026	0.2982	0.0221	1.8860	0.0417
F12 + F13 right threshold	0.1490	0.9853	0.1309	0.1290	0.0221	0.7350	0.0162
		Totals	1.6085	1.6150		Total	0.2306

Other parameters needed for calculation, taken from simulations:

λ_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*** **1.89** m³/(m·h)

Opening light length	10.2200	m	Total air leakage	19.316	m³/h
L_{50}	4.43	m³/(m²·h)	Heat loss = 0.0165 L_{50}	0.07	W/(m²·K)

BFRC Rating =	
218.6g_d - 68.5 x (U_d + Effective L_{50}) =	**3.32**
Climate zone is:	**UK**

Thermal transmittance, W/(m²·K)	U_{door}	**1.2**
Solar factor	g_{door}	**0.41**
Door air leakage heat loss, W/(m²·K)	L_{factor}	**0.07**

Simulator Name: M Castle

BFRC Certified Simulator No **039**

Signed…

M. Castle

Mark Castle
T. 01249 810415 F. 01249 815234
mark.castle@deceuninck.com