CERTIFIED SIMULATOR
No. 039

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
The Residence Collection
Window Widgets (2006) Limited
Unit C
Quedgeley West Business Park
Bristol Road
Gloucester
GL2 4PA

Date
17th July 2016

Report
R9_055

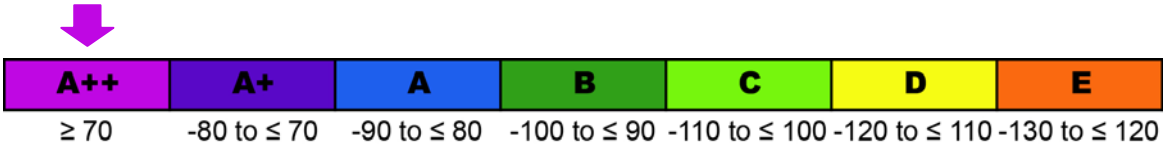
Door Profile
R7 Frame, Open Out Storm sash
Single Door, Fully Glazed

Insulated Glazing Unit
44mm unit size
4·16·4·16·4 configuration
4mm Planiclear · 16mm Argon (90%) · 4mm Planitherm Total+ · 16mm Argon (90%) · 4mm Planitherm Total+

Spacer Bar
Swisspacer Ultimate

Simulation Result Summary

Window U Value	Window g Value	L Factor	Energy Rating	Label Index
0.82	-	0.03	-58.28	-58



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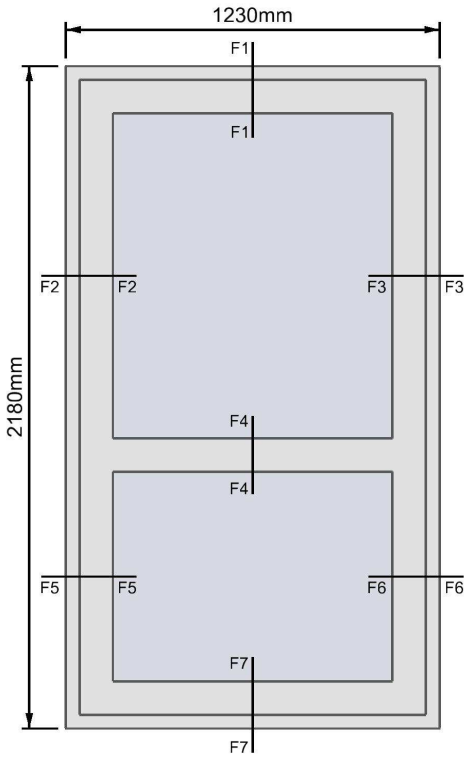
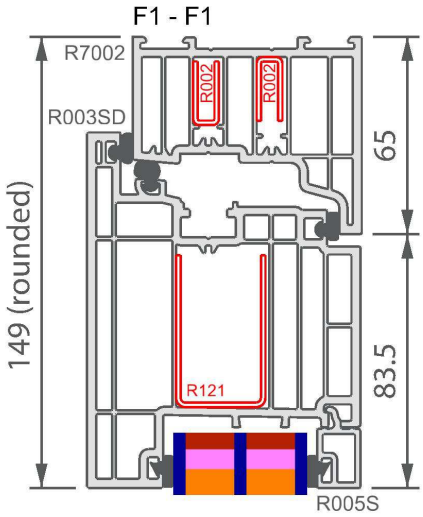
R9_055

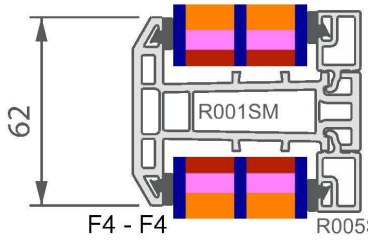
Door Profile

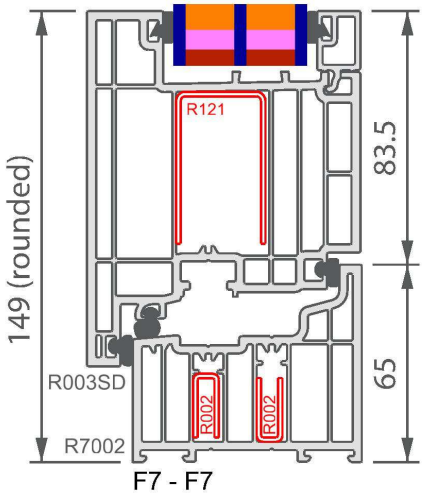


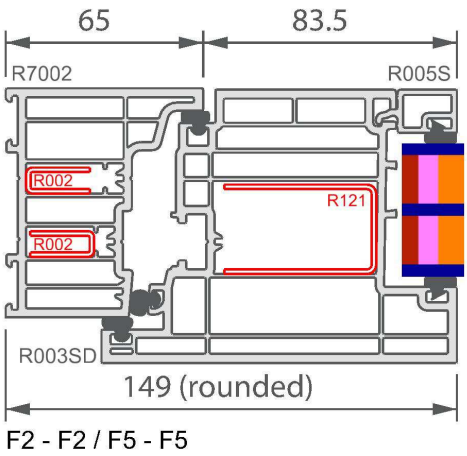
R7

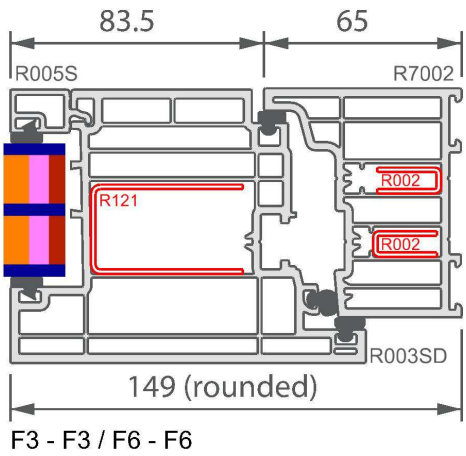
Open Out
Single Door
Storm Sash
Triple Glazed











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THE RESIDENCE COLLECTION

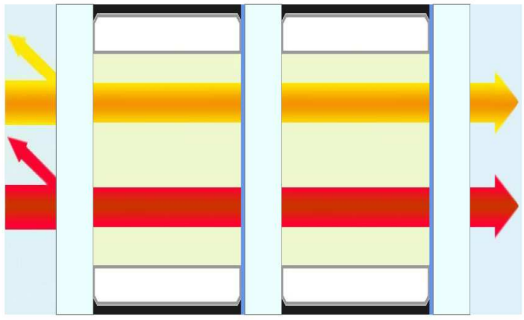
R9_055

Glass Unit Specification

SAINT-GOBAIN

Calumen® II 1.3.1
30 January 2015
Data base : SGG UK

Glazing design



Outdoor Indoor

	First glazing	Second glazing	Third glazing
Gas		Argon 90% 16.00mm	Argon 90% 16.00mm
Coating		PLANITHERM TOTAL+	PLANITHERM TOTAL+
First glass	PLANICLEAR 4.00mm	PLANICLEAR 4.00mm	PLANICLEAR 4.00mm
Coating			
Layer			
Coating			
Second glass			
Coating			

Manufacturing sizes

Nominal thickness :	**44.0**	**mm**
Weight :	**30.0**	**kg/m²**

Luminous factors (EN410-2011) : (D65 2°)

Transmittance :	**72**	**%**
Outdoor reflectance :	**16**	**%**
Indoor reflectance :	**16**	**%**

Energy factors (EN410-2011) :

Transmittance :	**52**	**%**
Outdoor reflectance :	**25**	**%**
Indoor reflectance :	**25**	**%**
Absorptance A1 :	**6**	**%**
Absorptance A2 :	**11**	**%**
Absorptance A3 :	**6**	**%**

Solar factors (EN410-2011) :

g :	**0.63**
Shading coefficient :	**0.72**

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

Ug :	**0.6**	**W/(m².K)**

Calumen II

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SE1 1EU London

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R9_055

Glass Unit Specification (cont…)

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

Number of spaces
2

Glazing orientation		
	Vertical	
Resistivity panes	1	m·K/W

Outside

Spaces		1		2	
	Pane 1	90%	Pane 2	90%	Pane 3
		Gas		Gas	
		Argon		Argon	
Thickness (mm)	4.0	16	4.0	16	4
Normal emissivity		0.89 / 0.05		0.89 / 0.05	
$\sum d_j \cdot r_j$ =	0.012	Uncoated		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	λeff	ΔT
	W/(m²·K)	(m²·K)/W	W/(mK)		W/(mK)	
1	0.622	1.42542	0.0224	7.5	0.0224	7.5
2	0.622	1.42542	0.0224	7.5	0.0224	7.5

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THE RESIDENCE COLLECTION

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Spacer Bar Datasheet

April 2013 – No.19 – Revision index 0

'WARM EDGE' WORKING PARTY

BF

RAL GÜTEZEICHEN MEHRSCHEIBEN ISOLIERGLAS

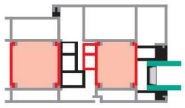
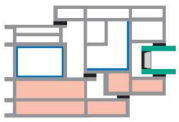
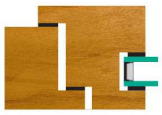
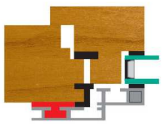
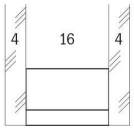
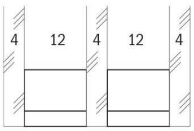
Data sheet Psi values for windows

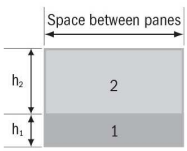
based on determination of the equivalent thermal conductivity of spacers by measurement

SWISSPACER®

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

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R9_055

Air Permeability Test Results
BS 6375-1:2015 / BS EN 1026:2000
Exova Warringtonfire Test Report No. WIL363354
Report Date 19th April 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	0.91	0.89	0.90	R9_055
100	1.42	1.45	1.44	
150	1.82	2.11	1.96	
200	2.15	2.91	2.53	
250	2.47	3.96	3.22	
300	2.77	5.01	3.89	
450	3.59	9.04	6.32	
600	4.20	11.71	7.96	

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R9_055

Component Material Specifications

Component	Material	Thermal Conductivity (W/mK)	Authority	Simulation it relates to
Framing	PVCU	0.17	EN 12524	R9_055
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_055
Secondary seal Depth 3.0mm	Butyl	0.24	EN 12524	

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THE RESIDENCE COLLECTION

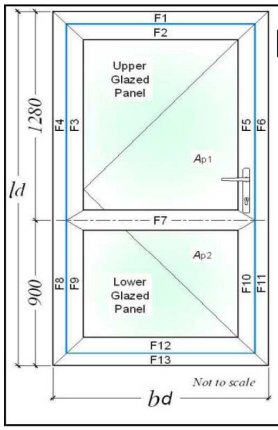
R9_055

Calculation Spreadsheet

Report Number: R9_055
Report Date: 21 June 2016
Project Details: R7/R3SD/R1SM/R4SQ_4mmFloat_16mmArgon_4mmTotal+_16mm Argon_4mmTotal+ with Swiss Ultimate (3.0mm Butyl)

Issue No 8.4 : *18/11/2015*

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



Sample Style: **Door Type 3**

Fully glazed residential door with mid rail

Blue line illustrates opening light length (air leakage)

Frame offset:	No

Nominal 4mm etc to ***0DP***, others ***1DP***

Upper Panel dim's and properties:		
Thickness of upper panel, $d_{g/p1}$	**44.0**	mm
Panel type:	**Glazing panel**	
Thermal Transmittance of panel - 3DP		
$U_{g/p1}$	**0.622**	W/(m²·K)
Lower Panel dim's and properties:		
Thickness of lower panel, $d_{g/p2}$	**44.0**	mm
Panel type:	**Glazing panel**	
Thermal Transmittance of panel - 3DP		
$U_{g/p2}$	**0.622**	W/(m²·K)

Thermal transmittance of door from hot box testing		
U_d - *2dp*		W/(m²·K)

Door Dimensions:

Panel	Length, l m	Width, b m	Area, A m²
Glazing panel	1.1000	0.9320	1.0252
Glazing panel	0.7200	0.9320	0.6710
Total of glazing + panel			1.6962
Frame	m	m	m²
F1	1.2300	0.0650	0.0757
F2	1.1000	0.0840	0.0853
F3	1.2150	0.0840	0.0972
F4	1.2800	0.0650	0.0811
F5	1.2150	0.0840	0.0972
F6	1.2800	0.0650	0.0811
F7	1.1000	0.0620	0.0630
F8	0.9000	0.0650	0.0564
F9	0.8350	0.0840	0.0653
F10	0.8350	0.0840	0.0653
F11	0.9000	0.0650	0.0564
F12	1.1000	0.0840	0.0853
F13	1.2300	0.0650	0.0757
Total Frame			0.9852
Total Door, A_d			2.6814
Percentage upper panel area			38.23%
Percentage lower panel area			25.03%

U_{door}			
	No bars; or attached bars	**0.82**	W/(m²·K)
	Single cross bar in IGU	**0.9**	
	Multiple cross bar in IGU	**1.0**	
	Glazing bar (Georgian bar)	**1.2**	

Energy Door
Energy Index
-58
Door Rating
A++

BFRC Rating
kWh/(m²·yr)
≥-70 A++ ✓
-80 to <-70 A+
-90 to <-80 A
-100 to <-90 B
-110 to <-100 C
-120 to <-110 D
-130 to <-120 E

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_w	2180	mm
Total door width ***0DP***	b_w	1230	mm

Frame dimensions (All frame dimensions to 0dp)	Frame heights, bf (mm) Internal	Frame heights, bf (mm) Combo
F1 fixed top rail	**65**	149
F2 moving top rail	**84**	
F3 top hinge (LH) jamb (moving sash)	**84**	149
F4 top hinge (LH) jamb (fixed frame)	**65**	
F5 top close (RH jamb (moving sash)	**84**	149
F6 top close (RH) jamb (fixed frame)	**65**	
F7 mid rail	**62**	62
F8 bottom hinge (LH) jamb (fixed frame)	65	149
F9 bottom hinge (LH) jamb (moving sash)	**84**	
F10 bottom close (RH) jamb (moving sash)	**84**	149
F11 bottom close (RH) jamb (fixed frame)	65	
F12 bottom moving rail	**84**	149
F13 bottom fixed rail	**65**	

Where a U_d value from hot box testing is available, no $L_f{}^{2D}$ or $L_\psi{}^{2D}$ values need to be entered

Frame conductance:	All L values to ***4DP***. All b values to ***0DP***				
		W/(m·K)	b_p (mm)	W/(m·K)	b_g (mm)
F1+F2 top rail	$L_f{}^{2D}$	**0.2897**	**200**	**0.2957**	200
F3+F4 top hinge (LH) jamb		**0.2897**	200	**0.2957**	200
F5+F6 top close (RH) jamb		**0.2897**	200	**0.2957**	200
F7 mid rail		**0.3398**	200	**0.3513**	200
			200		200
F8+F9 bottom hinge (LH) jamb		**0.2897**	200	**0.2957**	200
F10+F11 bottom close (RH) jamb		**0.2897**	200	**0.2957**	200
F12+F13 bottom rail		**0.2897**	200	**0.2957**	200

Frame: Section	Frame width, b_f m	Frame U-value, U_f W/(m²·K)	Frame area (no gaskets), A_f m²	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 top rail	0.1490	1.0038	0.1611	0.1617	0.0217	0.9320	0.0203
F3+F4 top hinge jamb	0.1490	1.0038	0.1783	0.1790	0.0217	1.1000	0.0239
F5+F6 top close jamb	0.1490	1.0038	0.1783	0.1790	0.0217	1.1000	0.0239
F7 mid rail	0.0620	0.9600	0.0630	0.0605	0.0430	0.9320	0.0401
F8+F9 btm. hinge jamb	0.1490	1.0038	0.1217	0.1222	0.0217	0.7200	0.0157
F10+F11 btm. Cls. jamb	0.1490	1.0038	0.1217	0.1222	0.0217	0.7200	0.0157
F12+F13 bottom rail	0.1490	1.0038	0.1611	0.1617	0.0217	0.9320	0.0203
		Totals	0.9852	0.9861		Total	0.1597

Air Leakage loss:
Air leakage at 50 Pa per hour & per unit length of opening light (BS 6375-1) - ***2DP*** **0.9000** m³/(m·h)

Opening light length	6.3000	m	Total air leakage	5.670	m³/h
L_{50}	2.11	m³/(m²·h)	Heat loss = 0.0165 L_{50}	0.03	W/(m²·K)

Panel thickness,			$d_{p1} = d_{g1}$ =	0.044		$d_{p2} = d_{g2}$ =	0.044	m
λ_p =	0.035	W/(m·K)	R_{se} =	0.04	m²·K /W	R_{se} =	0.13	m²·K/W
R_{p1} =	1.2571	m²·K /W	R_{tot1} =	1.4271	m²·K/ W	U_{p1} =	0.7007	W/(m²·K)
R_{p2} =	1.2571	m²·K /W	R_{tot2} =	1.4271	m²·K/ W	U_{p2} =	0.7007	W/(m²·K)

BFRC Rating =	
-68.5 x (U_{door} + Effective L_{factor}) =	**-58.28**
Climate zone is:	**UK**

Thermal transmittance, W/(m²·K)	U_{door}	**0.82**
Door air leakage heat loss, W/(m²·K)	L_{factor}	**0.03**

Simulator Name: **Mark Castle**

BFRC Certified Simulator No **039**

Signed…

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