



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

2nd July 2016

Report

R9_073

Door Profile

R9 Frame, Open Out Storm sash
Double Door

Insulated Glazing Unit

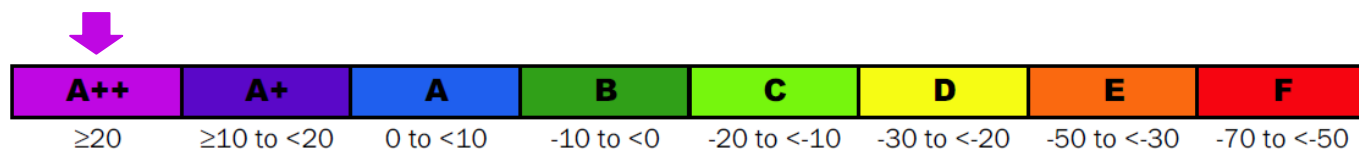
44mm unit size
4·16·4·16·4 configuration
4mm Planiclear · 16mm Argon (90%) · 4mm Planitherm Total+ · 16mm Argon (90%) ·
4mm Planitherm Total+

Spacer Bar

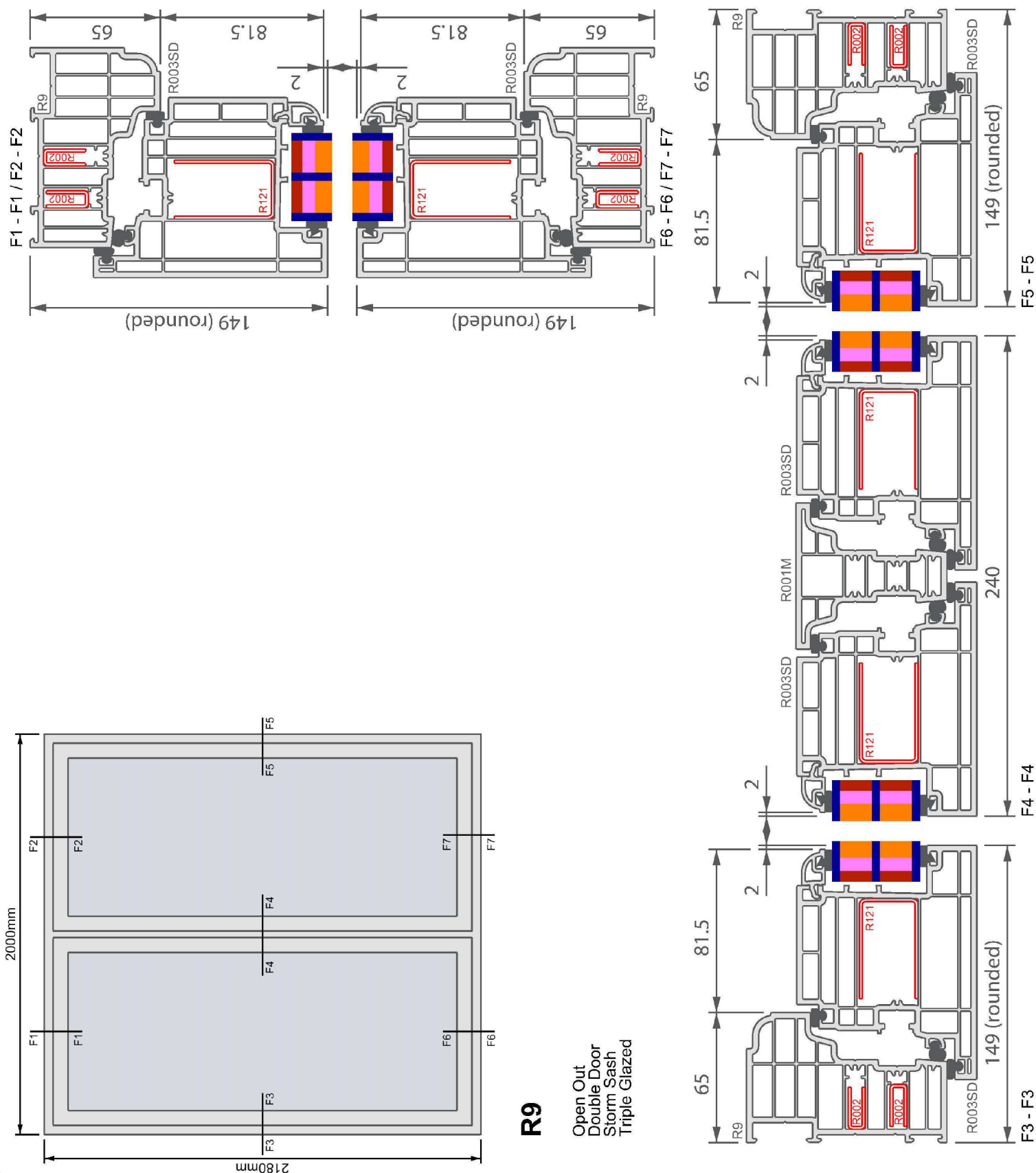
Swisspacer Ultimate

Simulation Result Summary

Window U Value	Window g Value	L Factor	Energy Rating	Label Index
0.79	0.36	0.07	19.79	20



Door Profile





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Glass Unit Specification

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

Glazing design



	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)**



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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 ISO9050-2003 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.

Calculating rules and functional extent of Calumen II have been validated by TÜV Rheinland Quality Service 440228-11-00705



• 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		2	
Glazing orientation		Vertical	
Resistivity panes	1	m·K/W	
Outside		Spaces	
		1	2
		P a n e 1	P a n e 2
		90%	90%
		Gas	Gas
		Argon	Argon
Thickness (mm)	4.0	16	4.0
Normal emissivity		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	$\sum 1/h_s$
	$W/(m^2 \cdot K)$	$(m^2 \cdot K)/W$
1	0.622	1.42542
2	0.622	1.42542

λ_{eff}	ΔT
$W/(mK)$	
0.0224	7.5
0.0224	7.5

λ_{eff}	ΔT
$W/(mK)$	
0.0224	7.5
0.0224	7.5

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

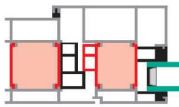
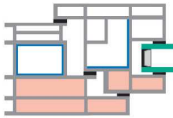
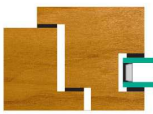
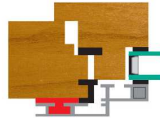
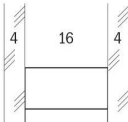
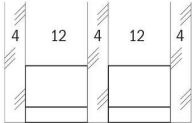
SWISSPACER®

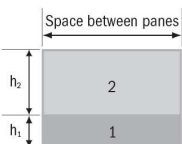
Vetrotech Saint-Gobain (International) AG
Zweigniederlassung Kreuzlingen
Sonnenwiesenstrasse 15
CH-8280 Kreuzlingen

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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No. 039

R9_073



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_073
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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R9_017

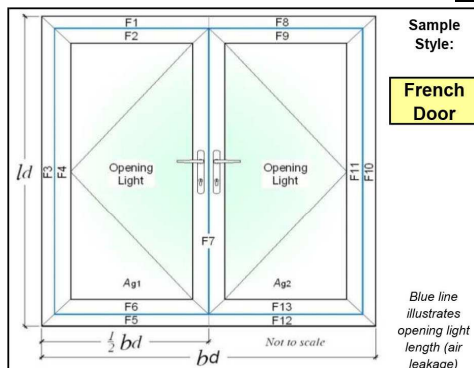
Component Material Specifications

Component	Material	Thermal Conductivity (W/mK)	Authority	Simulation it relates to
Framing	PVCU	0.17	EN 12524	R9_017
Glazing bead	PVCU	0.17	EN 12524	
Gasket/weatherseal	Q-Ion	0.06	Manufacturers stated value	
Glass	Saint Gobain	1.00	EN 12524	

Spacer bar

Thermobar	Glass fibre reinforced polypropylene, polyester coated film, with desiccant	0.14	WA-17/1 BF datasheet 27	R9_017
Secondary seal Depth 3.0mm	Butyl	0.24	EN 12524	

Calculation Spreadsheet



Sample Style:

French Door

Report Number: **R9_073**
Report Date: **4th April 2016**
Project Details: **R2/R3SD/R1M/R4_4mmPlaniclear_16mmArgon_4mmTotal+_16mmArgon_4mmTotal+ with Swiss Ultimate (3.0mm Butyl)**

Issue 2.5: 16/11/2015

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Input Values:

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

Frame offset: **Yes**

Nominal 4mm etc to 0DP , others 1DP	
Glazing dimensions and properties:	
Thickness of pane 1	4 mm
Pane 1/2 distance	16 mm
Gas fill (1/2)	Argon 90%
Thickness of pane 2	4 mm
Complete next 3 cells for TG IGU	
Pane 2/3 distance	16 mm
Gas fill (2/3)	Argon 90%
Thickness of pane 3	4.0 mm
Glazing Trans. - 3DP	U_g 0.622 W/(m ² ·K)
g-value - 2DP	g_d 0.63

Thermal transmittance of door from hot box test
 U_{d-2dp} **0.622** 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 0.36

U_{door}	No bars; or attached bars	0.79	$W/(m^2 \cdot K)$
	Single cross bar in IGU	0.9	
	Multiple cross bar in IGU	1.0	
	Glazing bar (Georgian bar)	1.2	

Energy Door		BFRC Rating	
Energy Index		kWh/(m ² ·yr)	
20		A++	
Door Rating		A+	
A+		A+	

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	
			2	0.0		
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_d value from hot box testing is available, no L_{f-20} or $L_{\psi-20}$ values need to be entered					
All L values to 4DP . All b values to 0DP					
Frame conductance:	L_{f-20}	W/(m·K)	b _f (mm)	$L_{\psi-20}$	W/(m·K)
F1 + F2 left head rail		0.2774	200		0.2834
F3 + F4 left jamb		0.2774	200		0.2834
F5 + F6 left threshold		0.2774	200		0.2834
F7 Meeting Stile		0.5029	400		0.5150
F8 + F9 right head rail		0.2774	200		0.2834
F10 + F11 right jamb		0.2774	200		0.2834
F12 + F13 right threshold		0.2774	200		0.2834

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
Section	(m)	(W/(m ² ·K))	(m ²)	(W/K)	(W/(m·K))	(m)	(W/K)
F1 + F2 left head rail	0.1490	0.9212	0.1329	0.1224	0.0217	0.7350	0.0160
F3 + F4 left jamb	0.1490	0.9212	0.3026	0.2788	0.0217	1.8860	0.0410
F5 + F6 left threshold	0.1490	0.9212	0.1329	0.1224	0.0217	0.7350	0.0160
F7 Meeting Stile	0.2400	0.9276	0.4718	0.4377	0.0436	1.8860	0.0822
F8 + F9 right head rail	0.1490	0.9212	0.1329	0.1224	0.0217	0.7350	0.0160
F10 + F11 right jamb	0.1490	0.9212	0.3026	0.2788	0.0217	1.8860	0.0410
F12 + F13 right threshold	0.1490	0.9212	0.1329	0.1224	0.0217	0.7350	0.0160
Totals	1.6085		1.4848		Total		0.2281

Other parameters needed for calculation, taken from simulations:
 $\lambda_p = 0.035$ W/(m·K) $R_{se} = 0.04$ m²·K/W $d_p = d_g = 0.044$ m
 $R_p = 1.2571$ m²·K/W $R_{tot} = 1.4271$ m²·K/W $R_{se} = 0.13$ m²·K/W
 $U_p = 0.7007$ 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 =	
218.6g_d - 68.5 x (U_d + Effective L₅₀) =	
19.79	
Climate zone is:	
UK	
Thermal transmittance, W/(m²·K)	U_{door} 0.8
Solar factor	g_{door} 0.36
Door air leakage heat loss, W/(m²·K)	L_{factor} 0.07

Simulator Name: **M Castle**

BFRC
BFRC Certified Simulator No
039

Signed...



M. Castle