

Calculation for Thermal Transmittance of PVCU Windows
In Accordance with
BS EN ISO 10077-2:2003
U Value Simulation by Physibel Bisco 9.0w

Client
Eclectic Systems
Unit C
Quedgeley Trading Estate West
Bristol Road
Gloucester
GL2 4PA

Date
30th January 2015

Report
R9_004

Window Profile
R9 Flush Casement
Standard frame, sash and mullion

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

Spacer Bar
Swisspacer V

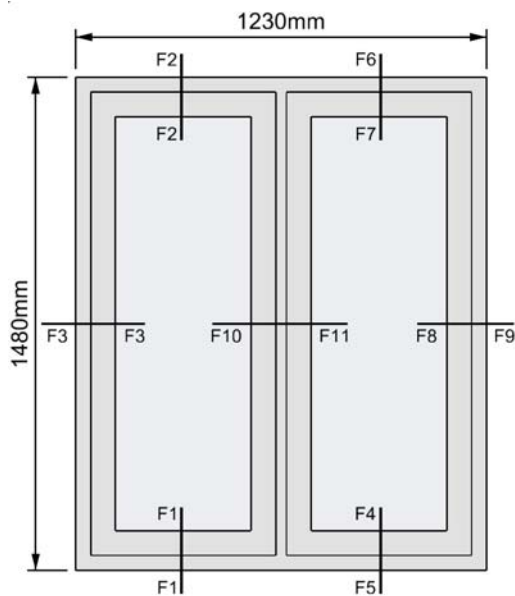
Simulation Result Summary

Window U Value	Window g Value	L Factor	Energy Rating	Label Index
1.22	0.38	0.01	-1.19	-1



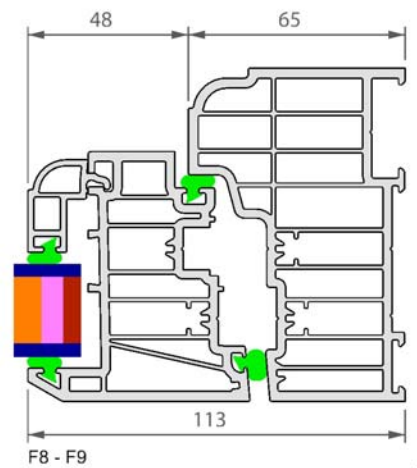
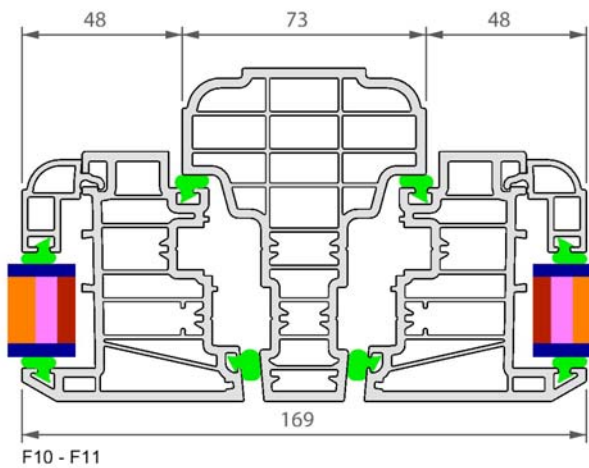
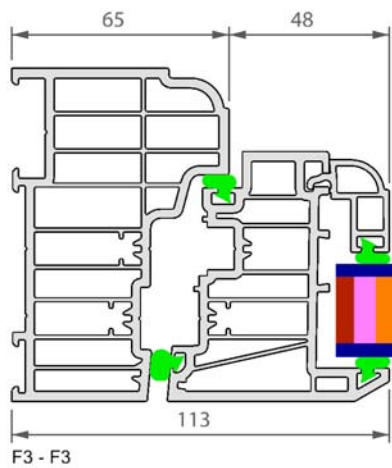
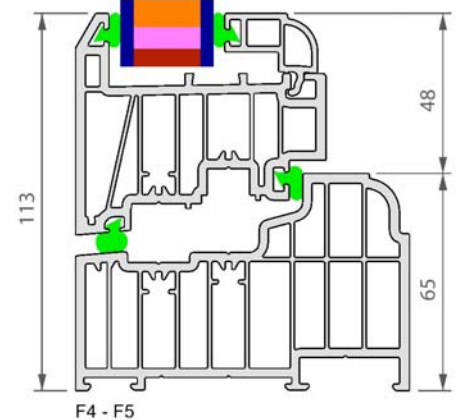
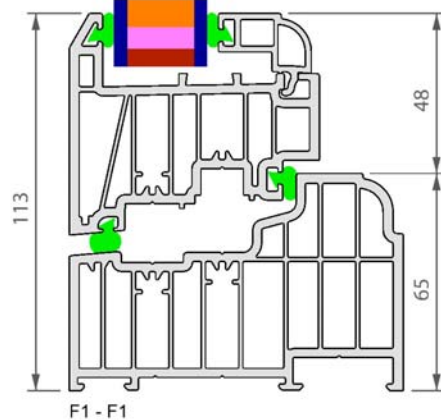
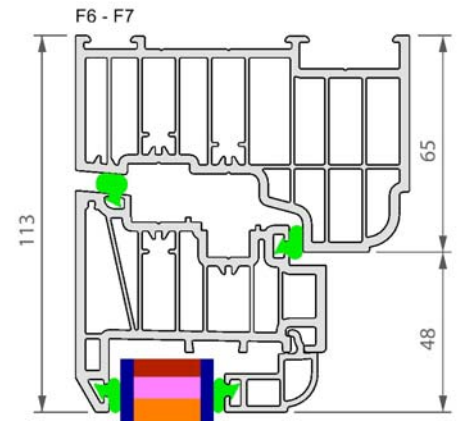
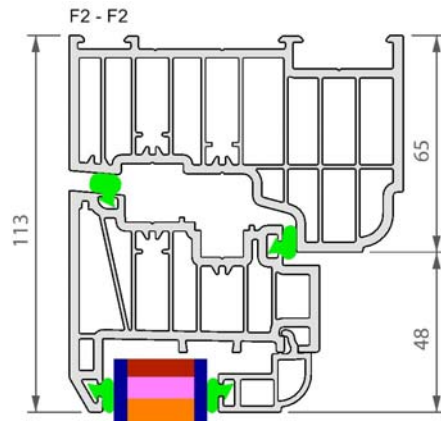
A+	A	B	C	D	E	F
≥ 10	0 to <10	-10 to <0	-20 to <-10	-30 to <-20	-50 to <-30	-70 to <-50

Window Profile



R9

Standard Frame
Double Glazed

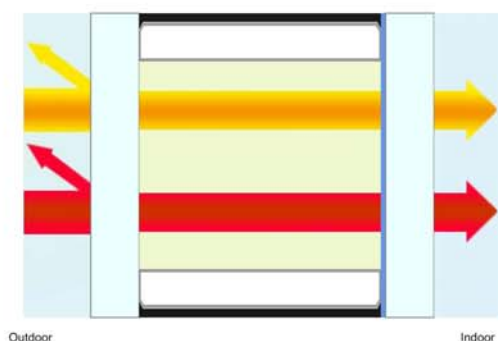


Glass Unit Specification



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

Glass Unit Specification (cont...)

Version 10 22/07/2011. Calculations according to BS EN 673:2011

Number of spaces
1

Spaces		1
Glazing orientation	Vertical	
Resistivity panes	1	m·K/W
Outside		
		P a n e 1 90% P a n e 2
		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

Iteration number	U value	$\sum 1/h_s$	λ_{eff}	ΔT
	W/(m ² ·K)	(m ² ·K)/W		
1	1.219	0.64228	0.0311	15
2	1.219	0.64228	0.0311	15



CERTIFIED SIMULATOR
No. 039

R9_004

Air Permeability Test Results
BS 6375-1:2009 / BS EN 1026:2000
Exova Warringtonfire Test Report No. WIL335987
Report Date 19th May 2014

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	0.33	0.31	0.32	R9_004
100	0.52	0.51	0.52	
150	0.68	0.68	0.68	
200	0.82	0.81	0.82	
250	0.96	0.94	0.95	
300	1.08	1.07	1.07	
450	1.42	2.03	1.72	
600	1.74	5.35	3.55	



CERTIFIED SIMULATOR
No. 039

R9_004

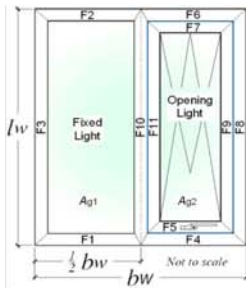
Component Material Specifications

Component	Material	Thermal Conductivity (W/mK)	Authority	Simulation it relates to
Framing	PVCU	0.17	EN 12524	R9_004
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

Swisspacer V	Plastic/stainless steel film	0.16	WA-17/1 BF datasheet 8	R9_004
Secondary seal Depth 5.5mm	Polysulfide	0.40	EN 12524	

Calculation Spreadsheet



Sample Style:
Casement
Fixed Light / Top Reversible

Blue line illustrates opening light length (air leakage)

Report Number: **R9_004** Issue No 22.1: 11/03/2013
Report Date: **30th Jan 2015**
Project Details: **R9 4mmPlaniclear_20mmArgon_4mmTotal+ with Swisspacer V (5.5mm PS)**

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

Input Values:

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

Parameter	Symbol	Units
Total window height ODP	l_w	1480 mm
Total window width ODP	b_w	1230 mm

Frame offset: **No**

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	0.73

Thermal transmittance of window from hot box test

U_w - **2DP** **W/(m²·K)**

Window Dimensions:

Section	Length		Width		Area	
	(m)	(m)	No gasket (m ²)	With gasket (m ²)		
Fixed Light	1.2540	0.4415	0.5536	0.5536		
Opening light	1.2540	0.3935	0.4934	0.4934		
Total glazing, A_g					1.0471	1.0471
Frame	(m)	(m)	(m ²)	(m ²)		
F1	0.6150	0.1130	0.0597	0.0597		
F2	0.6150	0.1130	0.0597	0.0597		
F3	1.4800	0.1130	0.1545	0.1545		
F4	0.6150	0.0650	0.0359	0.0359		
F5	0.4895	0.0480	0.0212	0.0212		
F6	0.6150	0.0650	0.0359	0.0359		
F7	0.4895	0.0480	0.0212	0.0212		
F8	1.4800	0.0650	0.0920	0.0920		
F9	1.3500	0.0480	0.0625	0.0625		
F10	1.4800	0.1210	0.1683	0.1683		
F11	1.3500	0.0480	0.0625	0.0625		
Total Frame					0.7733	0.7733
Total Window, A_w					1.8204	1.8204
Percentage fixed light glass area					30.41%	30.41%
Percentage opening light glass area					27.11%	27.11%
Percentage glass area (total)					57.52%	57.52%

Solar Factor, g-value:

F_w	0.9
g_w	0.38

U_{window}	No bars; or attached bars	1.22	$W/(m^2 \cdot K)$
	Single cross bar in IGU	1.3	
	Multiple cross bar in IGU	1.4	
	Glazing bar (Georgian bar)	1.6	

BFRC Rating kWh/(m ² ·yr)	Label index	EWER Rating Scale	Window Rating
≥10		A+	
0 to <10		A	
-10 to <-10		B	
-20 to <-20		C	
-30 to <-30		D	
-50 to <-50		E	
-70 to <-70		F	
	-1		B

Frame dimensions:

	(b _f)	Frame width, b _f (mm)	Gasket protrusion, b _{gf} (mm)	Frame & gasket widths (mm)	
All frame values round to nearest 1mm, gaskets to 1DP	F1 fixed sill	113		113.0	
	F2 fixed head	113		113.0	
	F3 fixed jamb	113		113.0	Total
F4 + F5 sash sill	F4 fixed sash sill	65	n/a	65.0	113.0
	F5 moving sash sill	48		48.0	
F6 + F7 sash head	F6 fixed sash head	65	n/a	65.0	113.0
	F7 moving sash head	48		48.0	
F8 + F9 sash jamb	F8 Fixed sash jamb	65	n/a	65.0	113.0
	F9 moving sash jamb	48		48.0	
F10 + F11 mullion	F10 fixed mullion	121		121.0	169.0
	F11 moving mullion	48		48.0	
Total gasket area			0	m ²	

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

Frame conductance:

Section	All L values to 4DP		All b values to ODP			
	$W/(m \cdot K)$	b_p (mm)	$W/(m \cdot K)$	b_g (mm)		
F1 fixed sill	0.3108	200	0.3817	200		
F2 fixed head	0.3108	200	0.3817	200		
F3 fixed jamb	0.3108	200	0.3817	200		
F4 + F5 sash sill	0.3108	200	0.3817	200		
F6 + F7 sash head	0.3108	200	0.3817	200		
F8 + F9 sash jamb	0.3108	200	0.3817	200		
F10 + F11 mullion	0.5792	400	0.7209	400		

Frame:

Section	Frame width, b _f (m)	Frame U-value, U _f (W/(m ² ·K))	Frame areas, A _f (m ²)	Frame heat flow, H _U (W/K)	near trans. (W/K)	Linear length, l _g (m)	Junction heat flow, H _ψ (W/K)
F1 fixed sill	0.1130	0.9258	0.0597	0.0553	0.0333	0.4415	0.0147
F2 fixed head	0.1130	0.9258	0.0597	0.0553	0.0333	0.4415	0.0147
F3 fixed jamb	0.1130	0.9258	0.1545	0.1430	0.0333	1.2540	0.0417
F4 + F5 sash sill	0.1130	0.9258	0.0571	0.0529	0.0333	0.3935	0.0131
F6 + F7 sash head	0.1130	0.9258	0.0571	0.0529	0.0333	0.3935	0.0131
F8 + F9 sash jamb	0.1130	0.9258	0.1545	0.1430	0.0333	1.2540	0.0417
F10 + F11 mullion	0.1690	0.9872	0.2308	0.2278	0.0665	1.2540	0.0834
Totals				0.7733	0.7301		0.2224

Air Leakage loss:

Air leakage at 50 Pa per hour & per unit length of opening light (BS 6375-1) - 2DP			0.32	m ³ /(m·h)
Opening light length	3.6790 m	Total air leakage	1.177	m ³ /h
L_{50}	0.65 m ³ /(m ² ·h)	Heat loss = 0.0165 L_{50}	0.01	W/(m ² ·K)

Other parameters needed for calculation, taken from simulations:

λ_p	0.035 W/(m·K)	R_{se}	0.04 ² ·K/W	R_{se}	0.13 m ² ·K/W
R_p	0.8000 m ² ·K/W	R_{tot}	0.9700 ² ·K/W	U_p	1.0309 W/(m ² ·K)

BFRC Rating =

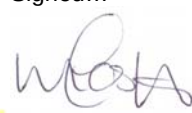
218.6g U_{window} - 68.5 x (U_{window} + Effective L_{50}) = **-1.19**

Climate zone is: **UK**

Thermal transmittance, W/(m ² ·K)	U_{window}	1.2
Solar factor	g_{window}	0.38
Window air leakage heat loss, W/(m ² ·K)	L_{factor}	0.01



Signed...



BFRC Certified
Simulator **039**

M. Castle