

Window Energy Rating (WER)

Report in Accordance with BFRC Guidelines and Regulations

Report reference: SWER148
Issue date: 15th July 2010
Prepared for: BSI
System: Dualframe 75mm
Prepared by: Ms Becky Hewlett
BFRC certified simulator No. 038



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Introduction

Frame Properties

The thermal performance calculations of the window configurations detailed are provided by computer simulation using LBNL THERM Finite element simulator software program THERM 5.2 and validated against proofs in Annex D (D1 to D10) of BS EN ISO 10077-2:2003.

Glazing Properties

The glazing gas space effective conductivity (Keff) and centre pane U value are calculated using the BFRC BS EN 673 spreadsheet, (Version 9.0 - July 2010)

The g value of the glazing is calculated using Saint-Gobain Calumen II software, (Version 1.0.0)

Note - insulating glass units must comply with BS EN 1279-5:2005

Air Leakage properties

Air leakage data is provided from a UKAS accredited air permeability test report by BSI (Report No 261/4676528)

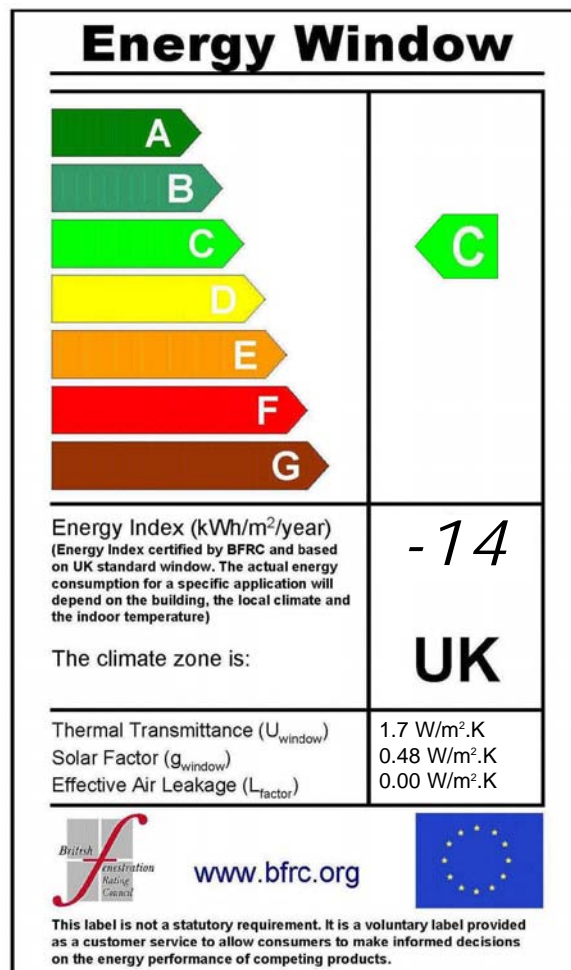
Whole Window Properties

The overall window U value, g value, L factor and energy rating index, are calculated using BFRC spreadsheet (Issue 21 - 4.3.2009)

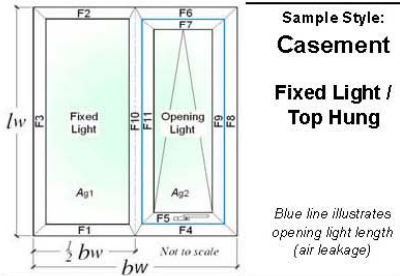
Window Specification

<i>Window System:</i>	Dualframe 75mm Casement
<i>Outerframe:</i>	DF310
<i>Ventframe:</i>	DF333
<i>Transom/Mullion:</i>	DF326
<i>Beading:</i>	DF215
<i>Glazing:</i>	4/16/4 Saint-Gobain Double glaze unit Diamant, 90% Argon, Planitherm Total+, Planilux
<i>Spacer:</i>	Edgetech Superspacer (0.122 W/m-K, Total depth 10mm) Primary seal - N/A Secondary seal - Butyl Rubber (Isobutene) (0.24 W/m-K)

Window Rating Label



BFRC Window Energy Rating Spreadsheet



Sample Style:
Casement
Fixed Light / Top Hung

Blue line illustrates opening light length (air leakage)

Report Number: **SWER148** Issue No.21: 04/03/2009
 Report Date: **15.7.10**
 Project Details: **Dualframe 75mm Casement - Profiles DF310, 333, 326, 215 SG(4/16/4)Diamant/ 90% Argon /Planitherm Total+, Super spr**

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

Parameter	Symbol	Value	Units
Total window height 0DP	i_w	1480	mm
Total window width 0DP	b_w	1230	mm

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		mm	
Gas fill (2/3)			
Thickness of pane 3		mm	
Glazing Trans. - 3DP	U_g	1.197	W/(m ² ·K)
g-value - 2DP	g	0.74	

Thermal transmittance of window from hot box test		
$U_w - 2DP$		W/(m ² ·K)

Frame dimensions:	(b_f)	Without gasket	Gasket protrusion	With gasket	
		(mm)	(mm)	(mm)	
All frame values to nearest 0.5mm, gaskets to 1DP	F1 fixed sill	57.5	3.0	60.5	Total
	F2 fixed head	57.5	3.0	60.5	
	F3 fixed jamb	57.5	3.0	60.5	
F4 + F5 sash sill	F4 fixed sash sill	57.5	n/a	57.5	89
	F5 moving sash sill	28.5	3.0	31.5	
F6 + F7 sash head	F6 fixed sash head	57.5	n/a	57.5	89
	F7 moving sash head	28.5	3.0	31.5	
F8 + F9 sash jamb	F8 Fixed sash jamb	57.5	n/a	57.5	89
	F9 moving sash jamb	28.5	3.0	31.5	
F10 + F11 mullion	F10 fixed mullion	66	3.0	69	100.5
	F11 moving mullion	28.5	3.0	31.5	
Total gasket area		0.021918		m ²	

Window Dimensions:		Area		
Section	Length (m)	Width (m)	No gasket (m ²)	With gasket (m ²)
Fixed Light	1.3650	0.5245	0.7159	0.7046
Opening light	1.3080	0.4675	0.6115	0.6009
Total glazing, A_g			1.3274	1.3055
Frame	(m)	(m)	(m ²)	(m ²)
F1	0.6150	0.0575	0.0328	0.0343
F2	0.6150	0.0575	0.0328	0.0343
F3	1.4800	0.0575	0.0818	0.0859
F4	0.6150	0.0575	0.0328	0.0328
F5	0.5245	0.0285	0.0141	0.0155
F6	0.6150	0.0575	0.0328	0.0328
F7	0.5245	0.0285	0.0141	0.0155
F8	1.4800	0.0575	0.0818	0.0818
F9	1.3650	0.0285	0.0381	0.0420
F10	1.4800	0.0660	0.0939	0.0980
F11	1.3650	0.0285	0.0381	0.0420
Total Frame		0.4930	0.5149	
Total Window, A_w		1.8204	1.8204	
Percentage fixed light glass area		39.33%	38.71%	
Percentage opening light glass area		33.59%	33.01%	
Percentage glass area (total)		72.92%	71.72%	

Where a U_g value from hot box testing is available, no $L_{f,2D}$ or $L_{w,2D}$ values need to be entered					
Frame conduction:	Section	All L values to 4DP . All b values to 0DP		$L_{f,2D}$	$L_{w,2D}$
		$W/(m \cdot K)$	b_f (mm)		
	F1 fixed sill	0.3736	190		0.4053 190
	F2 fixed head	0.3736	190		0.4053 190
	F3 fixed jamb	0.3736	190		0.4053 190
	F4 + F5 sash sill	0.4731	190		0.5053 190
	F6 + F7 sash head	0.4744	190		0.5065 190
	F8 + F9 sash jamb	0.4744	190		0.5065 190
	F10 + F11 mullion	0.7013	380		0.7672 380

Frame:	b_f (no gaskets)	U_f	Frame areas (no gaskets)	Heat flow	ψ	l_g	Heat flow
Section	(m)	(W/(m ² ·K))	(m ²)	(W/K)	(W/(m·K))	(m)	(W/K)
F1 fixed sill	0.0575	2.6359	0.0328	0.0864	0.0263	0.5245	0.0138
F2 fixed head	0.0575	2.6359	0.0328	0.0864	0.0263	0.5245	0.0138
F3 fixed jamb	0.0575	2.6359	0.0818	0.2156	0.0263	1.3650	0.0359
F4 + F5 sash sill	0.0860	2.9193	0.0469	0.1369	0.0268	0.4675	0.0125
F6 + F7 sash head	0.0860	2.9345	0.0469	0.1376	0.0267	0.4675	0.0125
F8 + F9 sash jamb	0.0860	2.9345	0.1199	0.3518	0.0267	1.3080	0.0349
F10 + F11 mullion	0.0945	2.7220	0.1320	0.3592	0.0551	1.3365	0.0737
Totals		0.4930	1.3739		Total	0.1971	

Solar Factor, g-value:	F_w	0.9
	g_w	0.48

U_{window}	U_w	1.74	W/(m ² ·K)
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Air Leakage loss:			
Air leakage at 50 Pa per hour & per unit length of opening light (BS 6375-1) - 2DP		0.13	m ³ /(m·h)
Opening light length	3.7790	m	Total air leakage 0.491 m ³ /h
L_{50}	0.27	m ³ /(m ² ·h)	Heat loss = 0.0185 L_{50} 0.00 W/(m ² ·K)

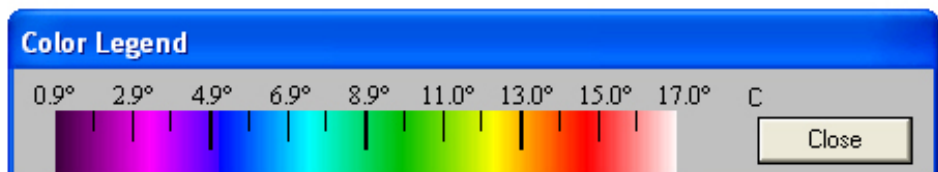
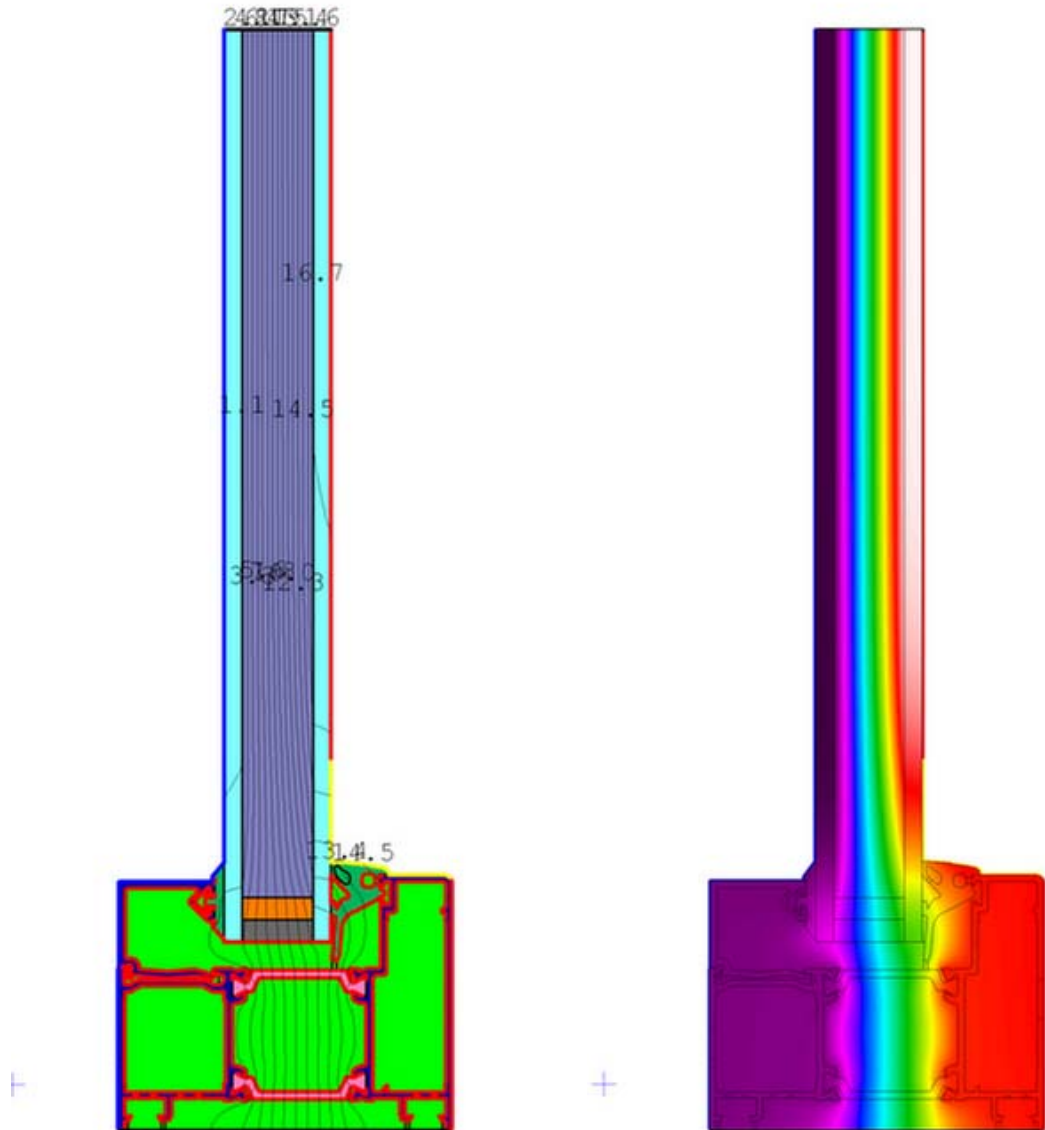
Other parameters needed for calculation, taken from simulations:
 $\lambda_p = 0.035$ W/(m·K) $R_{se} = 0.04$ m²·K/W $R_{so} = 0.13$ m²·K/W
 $R_p = 0.6857$ m²·K/W $R_{tot} = 0.8557$ m²·K/W $U_p = 1.1686$ W/(m²·K)

BFRC Rating	Label index	EWER Rating Scale	Window Rating
≥ 0	-14	A	C
-10 to <0		B	
-20 to <-10		C	
-30 to <-20		D	
-50 to <-30		E	
-70 to <-50		F	
<-70		G	

BFRC Rating =	218.6g window - 68.5 x (U_{window} + Effective L_{50}) =	-14.26
Climate zone is:		UK
Thermal transmittance, W/(m ² ·K)	U_{window}	1.7
Solar factor	g_{window}	0.48
Window air leakage heat loss, W/(m ² ·K)	L_{factor}	0.00
Simulator Name:	Ms Becky Hewlett	

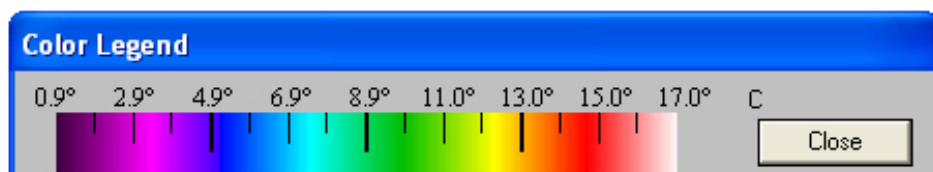
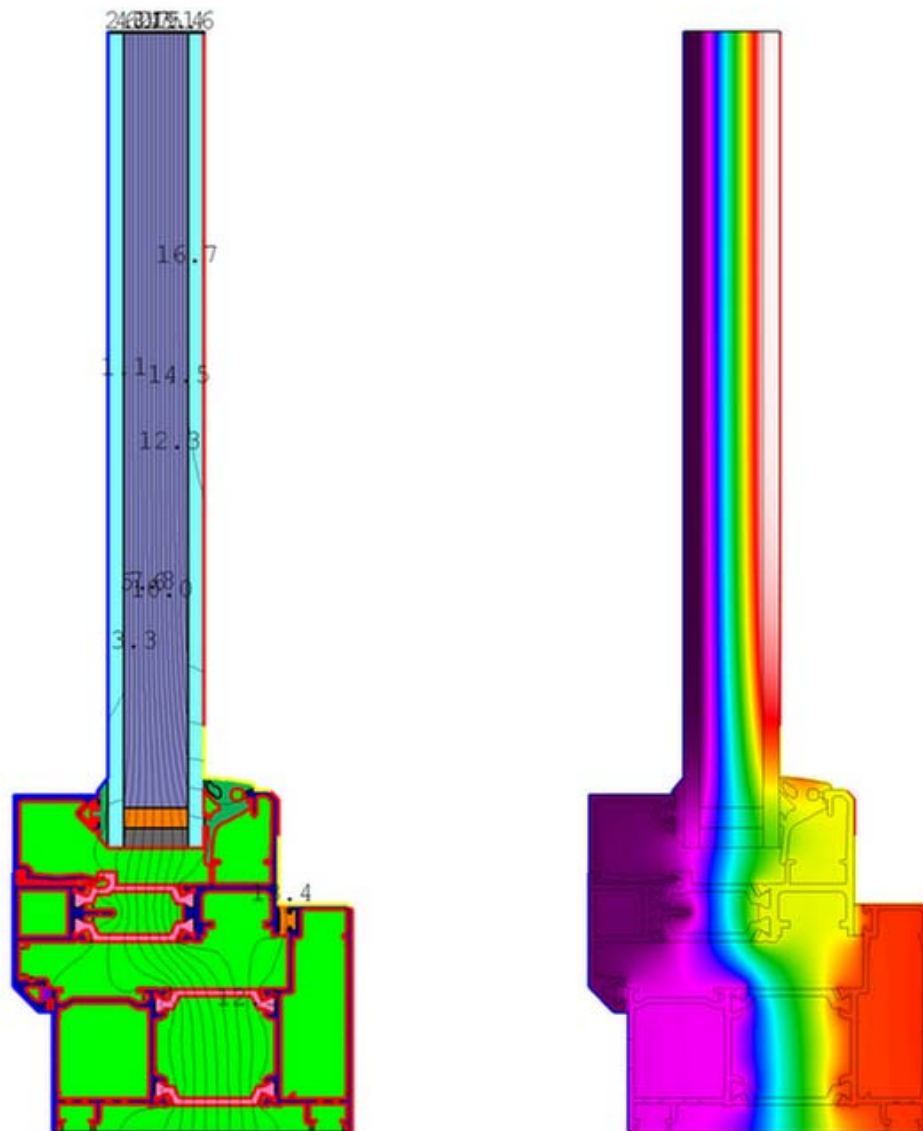


Thermal Simulation Analysis - Outerframe
Output From Therm 5.2



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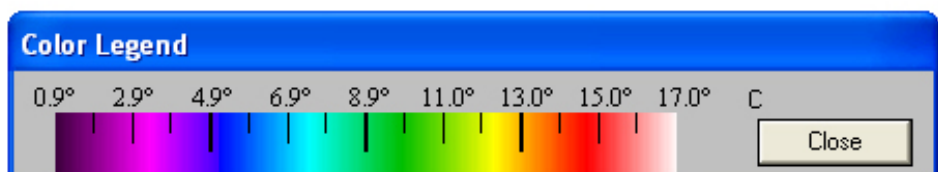
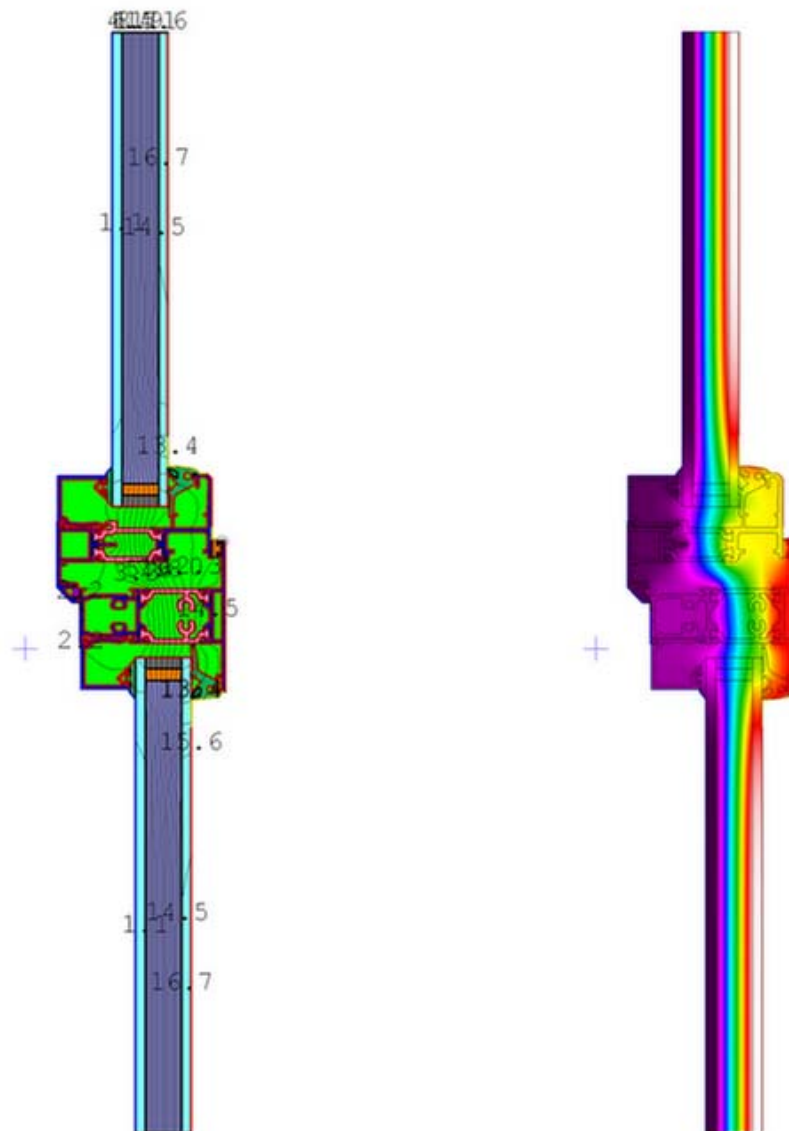
Thermal Simulation Analysis - Outerframe/Ventframe
Output From Therm 5.2



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Thermal Simulation Analysis - Mullion/Ventframe

Output From Therm 5.2



BS EN 673 Spreadsheet

Version 9 July 2010. Calculations according to BS EN 673:1998 (A1)

Number of spaces		1	
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Glazing orientation		Vertical	
Resistivity panes	1	m·K/W	

Spaces		1	
Outside		90%	
		P a n e 1	P a n e 2
		Gas	
		Argon	
Thickness (mm)	4.0	16	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

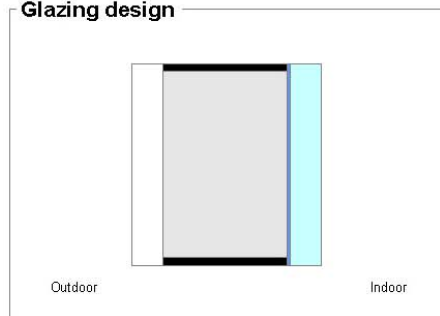
Iteration number	U value	$\sum 1/h_s$	λ_{eff}	ΔT
	W/(m ² ·K)	(m ² ·K)/W	W/(mK)	
1	1.197	0.65864	0.0243	15
2	1.197	0.65864	0.0243	15

Glass Supplier Information (EN410)



12 July 2010

Glazing design



	First glazing	Second glazing
Gas		Argon 90% 16mm
Coating		PLANITHERM TOTAL+
First glass	DIAMANT 4mm	PLANILUX 4mm
Coating		
Layer		
Coating		
Second glass		
Coating		

Manufacturing sizes

Nominal thickness : **24.0 mm**
Weight : **20.0 kg/m²**

Luminous factors

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

Energy factors EN 410

Transmittance : **63 %**
Outdoor reflectance : **22 %**
Indoor reflectance : **19 %**
Absorptance A1 : **3 %**
Absorptance A2 : **13 %**

Solar factor g : **0.74**
Shading coefficient : **0.85**

Thermal transmission - 0° related to vertical position

U_g : **1.2 W/(m²K)**



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This Calumen® II program has been approved by TNO S&I to do ITC (Initial Type Calculations), for the purpose of an ITT Report according to EN 673 and EN 410 intended uses. Ref. Report TNO No TC-RAP-06-17286/mso

The Calumen software calculates the spectrophotometric values of Saint-Gobain Glass products, and of combinations of those products. It is the responsibility of the user of this software to check if the intended use of the product is allowed, in respect with the current domestic regulations and standards. Saint-Gobain Glass cannot be considered as responsible if the software is used for wrong applications of glass products.

These values are calculated according to standards EN 410 (luminous and energy values) and EN 673 (thermal transmittance U_g). These computed values are average values, given for indicative purposes only and are subject to modifications. These computed values are average values, given for indicative purposes only and are subject to modifications. The tolerance is +/- 3% for the values of the light and energy factors and +/- 0.1 W/m².K for the value of the U_g coefficient.

BS4873 Air Leakage Report

Extract from Weather Performance Test report

Report No 261/4676528

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AIR PERMEABILITY TEST RESULTS

Clause 10.2 Air Permeability

Table 1

Air pressure (Pa)	Blank reading (m³/h)	Maximum total air flow (m³/h)	Actual rate of air leakage (m³/h)	Maximum rate of air leakage (m³/h)	Select the perimeter type (Opening or Gasket) (m³/h/m)
50	3.7	4.2	0.5	0.5	0.13
100	6.7	7.0	0.3	0.3	0.08
150	8.2	8.6	0.4	0.4	0.10
200	9.8	10.3	0.5	0.5	0.13
300	12.5	13.0	0.5	0.6	0.16
400	15.0	15.3	0.3	0.5	0.13
500	16.8	17.2	0.4	0.4	0.10
600	18.5	19.0	0.5	0.7	0.18
700	20.1	20.8	0.7	0.7	0.18
600	18.3	19.0	0.7	-	-
500	16.7	17.0	0.3	-	-
400	14.7	15.2	0.5	-	-
300	12.2	12.8	0.6	-	-
200	9.6	10.0	0.4	-	-
150	8.1	8.4	0.3	-	-
100	6.2	6.5	0.3	-	-
50	4.0	4.2	0.2	-	-

Opening perimeter (m) :3.86