THERMAL REPORT IN ACCORDANCE WITH BFRC GUIDELINES AND REGULATIONS

REPORT INFORMATION

Report Nº:	S158/20221215/002
Report Date:	15/12/2022
Simulator:	*David Macía Arias*
Signature	

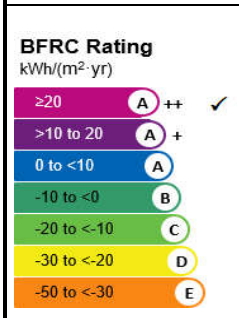
WINDOW SYSTEM SPECIFICATION

Manufacturer:	CORTIZO
System:	Cortizo Casement System
Type of Opening:	Casement
Air Leakage Details:	
Test Report	**Result Air permeability at 50 Pa**
Exova - WIL399383	0.22 m3/(hm)

GLAZING SPECIFICATION

Manufacturer:	Saint-Gobain
Composition:	Planiclear 4 mm (16 Argon 90%) ECLAZ 4 mm (16 Argon 90%) ECLAZ 4 mm
Thickness:	44 mm
Solar Factor: (according BS EN 410)	0.62 (62%)
Ug centre value: (according BS EN 673)	0.577 W/m2K

THERMAL PERFORMANCE



Thermal Transmittance (U_w)	1.05
Solar Factor (g_w)	0.43
Windows air leakage heat loss	0.01
Climate zone	UK
Energy Index	20.96
WER (Band/ rating)	A++

SPACE BAR SPECIFICATION

Reference:	W19-SWISSPACER ULTIMATE
Ref. data source:	BF- W19 datasheet April-2013
Secondary Sealant	
Dimension / Conductivity	
Sealant (TwoBox1):	3.0 mm / 0.40 W/(mK)
Spacer (TwoBox2):	6.5 mm / 0.14 W/(mK)

The frame profile results showed in this document has been obtained by computer simulation using the software Flixo Pro 8.1 and following BFRC guidelines. This is a computer-based tool based on the finite element method for the resolution of the 2-D heat transmission equation. This computer software has been tested used the examples proposed by the regulation BS EN ISO 10077-2:2017

ALUMINIOS CORTIZO S.A.U.
Lugar de Extramundi, S/N
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SPAIN.
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BFRC Certified Simulator No S158

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THERMAL CONDUCTIVITY VALUES

MATERIAL	STANDARD OR SOURCE	CONDUCTIVITY W/(mK)	EMISSIVITY
Aluminium (Si Alloys)	BS EN ISO 10077-2	160.000	0.90
EPDM	BS EN ISO 10077-2	0.250	0.90
Polyamid 6.6 with 25% GF	BS EN ISO 10077-2	0.300	0.90
Panel	BS EN ISO 10077-2	0.035	0.90
POLNA 30FR	Report nº21/25508-1444 (APPLUS)	0.036	0.90

AIR LEAKAGE REPORT - EXOVA WIL399383

AIR PERMEABILITY TEST RESULT - ACCORDING BS EN 1026 - Windows & Doors, Air permeability

Test Pressure	Calculated Air Permeability per unit length		
	Positive m^3 / h.m	Negative m^3 / h.m	Average m^3 / h.m
50 Pa	0.17	0.27	0.22
100 Pa	0.34	0.39	0.37

BS EN 673 CALCULATION

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 Argon		Gas Argon	
Thickness (mm)	4.0	16	4.0	16	4
Normal emissivity		0.89 / 0.03		0.89 / 0.03	
$\sum d_j \cdot r_j$ = 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	0.577	1.55032	0.0206	7.5	0.0206	7.5
2	0.577	1.55032	0.0206	7.5	0.0206	7.5

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GLASS DATA SHEET (Part1 :EN 410)

CORTIZO

SAINT-GOBAIN

DECLARATION OF PERFORMANCE

CE

Saint-Gobain Building Glass Europe

Tour Saint-Gobain 12 place de l'Iris 92400 Courbevoie France

EN 1279-5 - Insulating glass units
intended to be used in buildings and construction works

CLIMATOP ECLAZ F3 F5 4(16 argon)4 (16 argon)4

D3617138

NB: 0336, 0497, 0679, 0757, 0809, 1004, 1116, 1136, 1154, 1174, 1234, 1322, 1694, 1717, 1750, 1751

ESSENTIAL CHARACTERISTICS	AVCP SYSTEMS	PERFORMANCES
For uses relating to safety in case of fire:		
Resistance to fire	1	NPD
Reaction to fire	3,4	NPD
External fire performance	3,4	NPD
For uses as anti-bullet or anti-explosion glazing		
Bullet resistance	1	NPD
Explosion resistance	1	NPD
For uses liable to present "safety-in-use" risks and subject to such regulations		
Burglar resistance	3	NPD
Pendulum body impact resistance	3	NPD
Resistance against sudden temperature changes and temperature differentials (K)	4	40/40/40
Wind, snow, permanent and imposed load resistance (N/mm^2)	4	45-45-45
For uses relating to noise reduction		
Direct airborne sound insulation (dB)	3	32(-1;-5)
For uses relating to energy conservation		
Emissivity ε_s	3	NPD
U-value ($W/(m^2.K)$)	3	0.6
Light transmittance τ_v	3	0.77
Light reflectance ρ_v/ρ'_v	3	0.14/0.14
Solar direct transmittance τ_e	3	0.53
Solar direct reflectance	3	0.26/0.26
g-value	3	0.62
Durability	3	PASS

PLANICLEAR 4 mm / 1 - 16 argon / ECLAZ 4 mm / 1 - 16 argon / ECLAZ 4 mm

NPD : No Performance Determined

The performance of the product is in conformity with the declared performances.
This declaration of performance is issued under the sole responsibility of the manufacturer.
Signed for and on behalf of the manufacturer by:

Fabrice Desmons	13/10/2022
International Product Strategy Director Building Glass	Courbevoie - France

GLASS DATA SHEET
(Part 2: Emissivity value EN 12898)

CORTIZO

SAINT-GOBAIN

Calumen III 1.24

Wednesday, December 14, 2022

Pane 1	PLANICLEAR (4 mm) Annealed : Float ECLAZ

ECLAZ 4 mm

Saint-Gobain Building Glass
CITAV
Fernando de la Rubia
C/ Príncipe de Vergara, 132
28002 Madrid
España
0034 91 397 25 42
fernando.delarubia@saint-gobain.com

LUMINOUS FACTORS — CIE (15-2004)

Light transmission (TL %)	92 %
Outdoor reflection (RLe %)	5 %
Indoor (RLi %)	4 %

SOLAR FACTORS — EN410 (2011-04)

Solar factor (g)	0.73
Shading Coefficient (SC)	0.84

EMISSIVITIES

Normal emissivity side 1	0.89
Normal emissivity side 2	0.03

COLOR RENDERING — CIE (15-2004)

Transmission (Ra)	99.3
Reflection (Ra)	88.5

BURGLAR RESIST — EN356

Result :	NPD

CARBON FOOTPRINT — EN15804+A2

Global warming potential 'GWP' 12 Kg(CO2)/m² (A1-A3)

ENERGY FACTORS — EN410 (2011-04)

Transmission (Te)	72 %
Reflection (Ree)	18 %
Indoor (Rei)	19 %
Absorption (AE1)	11 %

THERMAL TRANSMISSION — EN673 (2011-04)

Ug	3.2 W/m².K

0° related to vertical position

MANUFACTURING SIZES

Nominal thickness	4.0 mm
Weight	10 kg/m²

PENDULUM RESISTANCE — EN12600

Result :	NPD

ACOUSTICS — EN12758

Acoustic values according to EN 12758 and from notified body -	Rw(C;Ctr) = 30(-2;-2) dB
OITC (ASTM E1332)	N/A
STC (ASTM E413)	N/A

Calumen III calculates the photometric characteristics and thermal transmission of glass using calculation algorithms which comply with the following standards: the European standards EN 410 and EN 673, the international standard ISO9050, the Japanese standard JIS R 3106/3107 and the Korean standard KS L 2514/2525. The functional output and calculation rules of Calumen for standards EN 410 and EN 673 have been validated by TÜV Rheinland (report 8121153-01). The technical performances obtained according to these standards are provided for information only and are subject to amendment.
Only the values entered in the performance declaration available on the CE marking site of Saint-Gobain Glass are official.
The sound attenuation indices are measured under laboratory conditions according to the standards EN ISO 10140 and EN 12758. The calculated indices are provided for information only. The accuracy for Rw index lies within a range of +/-2dB. The glass thickness calculations comply with the 2012 version of the DTU39-P4 description. The USER is responsible for ensuring that the correct calculation hypotheses are entered and the DTU39 is applied appropriately for the project concerned.

WARM EDGE WORKING PARTY
DATA SHEET - BF

CORTIZO

April 2013 – No. W19 – Revision index 4-06/2021 – valid until June 30th, 2023 'WARM EDGE' WORKING PARTY

BF

RAL GÜTEZEICHEN MEHRSCHEIBEN ISOLIERGLAS

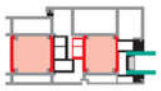
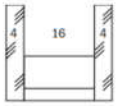
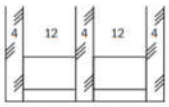
Data sheet Psi values for windows

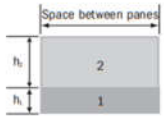
based on determination of the equivalent thermal conductivity of spacers by measurement

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
Profile description	ULTIMATE SWISSPACER 	6.5 Spacer category C	Metalized multilayer polyester film "High Tech Gas Barrier Foil"/ SAN-GF	~0.05 1.0

	Representative glass constructions	Metal with thermal break	Plastic	Wood	Wood/Metal
Representative frame profiles					
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

Two Box model Characteristic values	Space between panes in mm	$\lambda_{eq,2B}$ in W/mK	
		Box 1 · h_1 = 3 mm	Box 2 · h_2 = 6.5 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-17engl/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 U_W 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-08engl/3 "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 "Guide to Warm Edge" of Bundesverband Flachglas.

Characteristic values determined by:

ift ROSENHEIM

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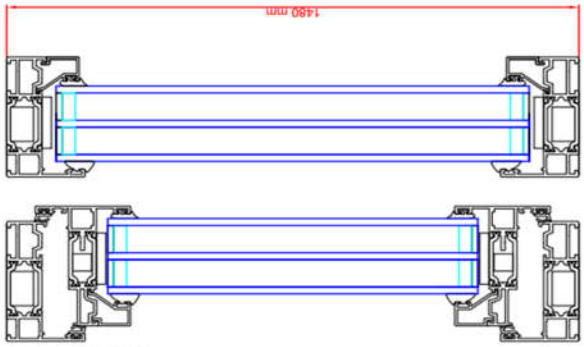
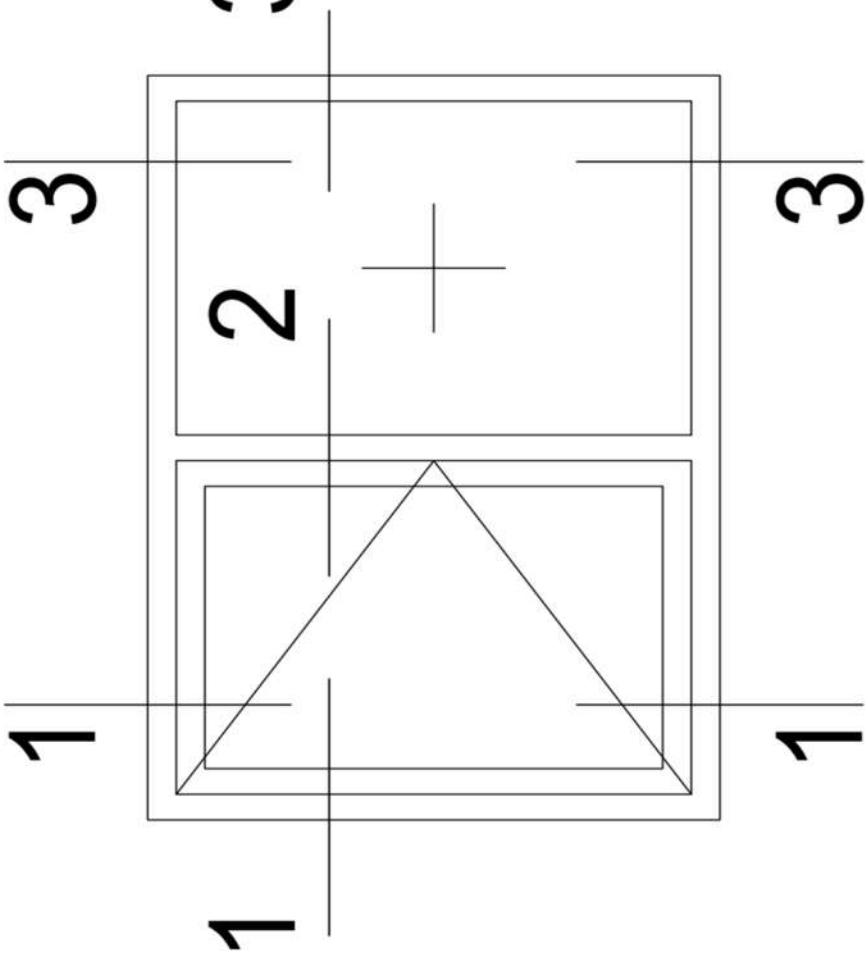
DRAWINGS

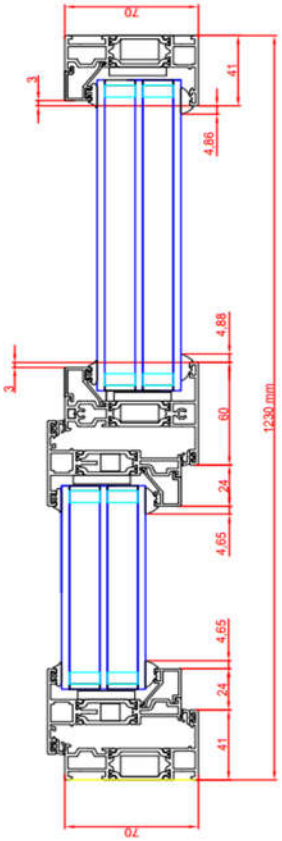
DO NOT SCALE

All dimensions are in mm.

Frame COR-3831
Sash COR-3821
Fly Mullion / interlock.....COR-3851
Bead: COR-3811







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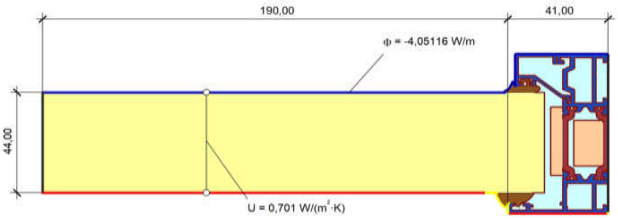
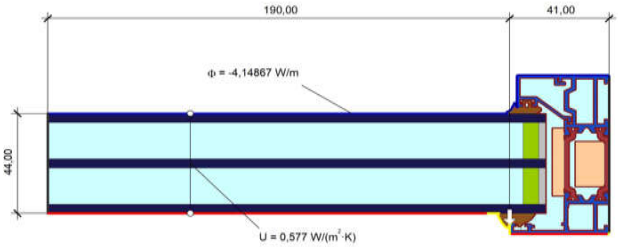
L2D VALUES (BS EN 10077-2)

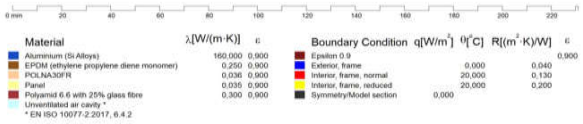
SECTION F1 - F2 - F3

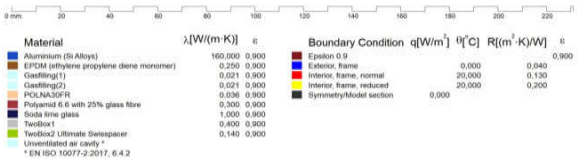


$$U_f = \frac{4,051}{20,000} - 0,701 \cdot 0,190 \over 0,041 = 1,6933 \text{ W/(m}^2\text{·K)}$$

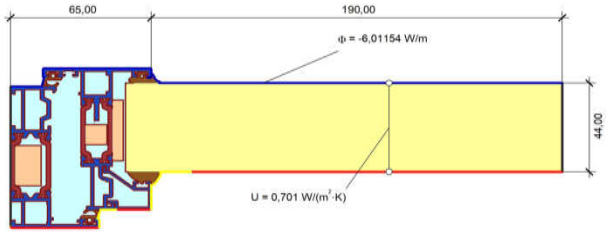


$$\Psi_{ed} = \frac{4,149}{20,000} - 0,577 \cdot 0,190 - 1,693 \cdot 0,041 = 0,02838 \text{ W/(m·K)}$$

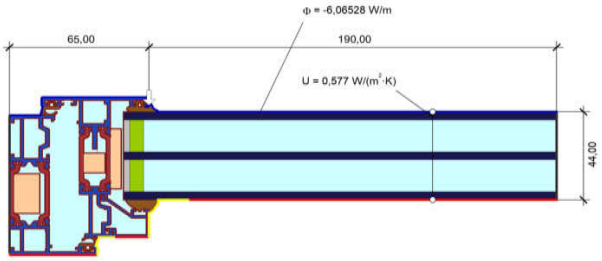




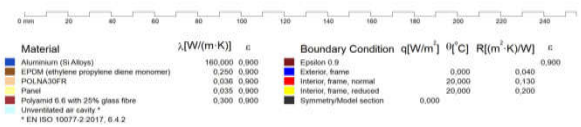
SECTION F4-F5-F6-F7-F8-F9

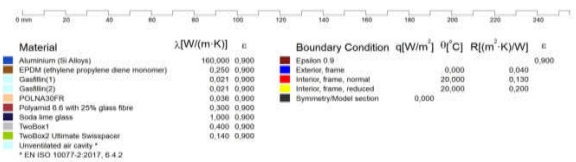


$$U_f = \frac{6,012}{20,000} - 0,701 \cdot 0,190 \over 0,065 = 2,5761 \text{ W/(m}^2\text{·K)}$$



$$\Psi_{ed} = \frac{6,065}{20,000} - 0,577 \cdot 0,190 - 2,576 \cdot 0,065 = 0,02619 \text{ W/(m·K)}$$





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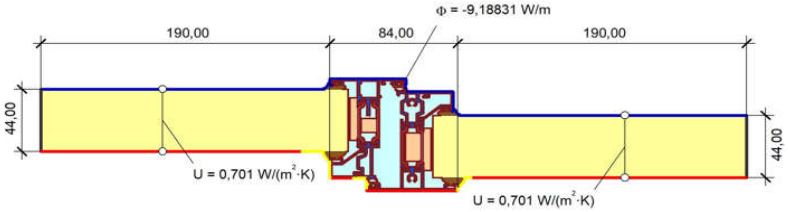
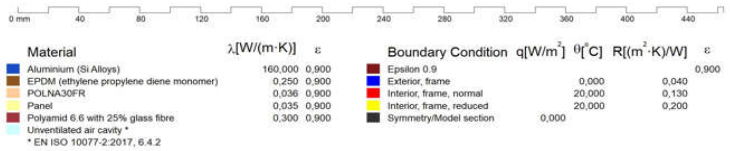
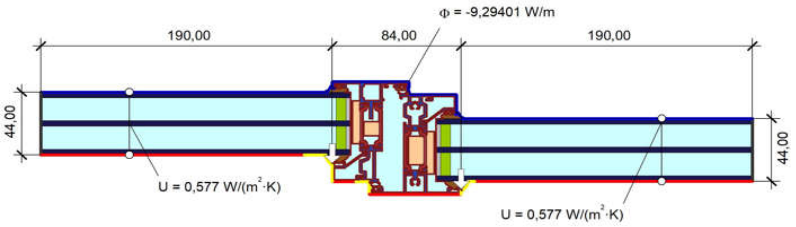
L2D VALUES (BS EN 10077-2)

SECTION F10-F11

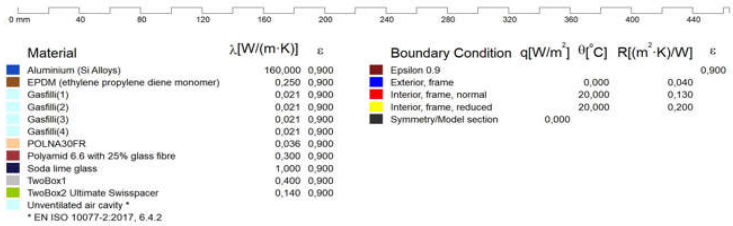


$$U_f = \frac{\frac{9,188}{20,000} - 0,701 \cdot 0,190 - 0,701 \cdot 0,190}{0,084} = 2,2994 \text{ W/(m}^2\text{·K)}$$





$$\Psi_{ed.} = \frac{\frac{9,294}{20,000} - 0,577 \cdot 0,190 - 2,299 \cdot 0,084 - 0,577 \cdot 0,190}{2} = 0,02615 \text{ W/(m·K)}$$



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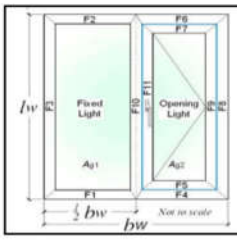
BFRC CALCULATION SHEET

CORTIZO



Sample Style:
Casement

Fixed Light / Side Hung

Blue line illustrates opening light length (air leakage)

Report Number: S158/20221215/002
Report Date: 15/12/2022
Issue No 22.3: 04/01/2016
Project Details: Cortizo Casement system (Triple glazing)

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

Parameter	Symbol		Units
Total window height *0DP*	l_w	1480	mm
Total window width *0DP*	b_w	1230	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		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	0.577	W/(m²·K)
g-value - *2DP*	$g_\perp$	0.62	

Thermal transmittance of window from hot box test		
U_w - *2DP*		W/(m²·K)

Frame dimensions:

	(b_f)	Frame width, b_f (mm)	Frame offset, b_{off}	Gasket protrusion, b_{gl} (mm)	Frame & gasket widths (mm)	
All frame values round to nearest 1mm, gaskets to *1DP*	F1 fixed sill	41	3	4.9	45.9	
	F2 fixed head	41	3	4.9	45.9	
	F3 fixed jamb	41	3	4.9	45.9	Total
F4 + F5 sash sill	F4 fixed sash sill	41		n/a	41.0	69.6
	F5 moving sash sill	24	0	4.6	28.6	
F6 + F7 sash head	F6 fixed sash head	41		n/a	41.0	69.6
	F7 moving sash head	24	0	4.6	28.6	
F8 + F9 sash jamb	F8 Fixed sash jamb	41		n/a	41.0	69.6
	F9 moving sash jamb	24	0	4.6	28.6	
F10 + F11 mullion	F10 fixed mullion	60	3	4.9	64.9	93.6
	F11 moving mullion	24	0	4.7	28.7	
	Total gasket area	0.0359682	m²			

Window Dimensions:

Section	Length (m)	Width (m)	Area No gasket (m^2)	Area With gasket (m^2)
Fixed Light	1.3980	0.5440	0.7605	0.7416
Opening light	1.3500	0.4960	0.6696	0.6526
Total glazing, A_g			1.4301	1.3941
Frame	(m)	(m)	(m^2)	(m^2)
F1	0.6150	0.0410	0.0238	0.0264
F2	0.6150	0.0410	0.0238	0.0264
F3	1.4800	0.0410	0.0590	0.0658
F4	0.6150	0.0410	0.0238	0.0238
F5	0.5440	0.0240	0.0125	0.0147
F6	0.6150	0.0410	0.0238	0.0238
F7	0.5440	0.0240	0.0125	0.0147
F8	1.4800	0.0410	0.0590	0.0590
F9	1.3980	0.0240	0.0330	0.0392
F10	1.4800	0.0600	0.0863	0.0932
F11	1.3980	0.0240	0.0330	0.0393
Total Frame			0.3903	0.4263
Total Window, A_w			1.8204	1.8204
Percentage fixed light glass area			41.78%	40.74%
Percentage opening light glass area			36.78%	35.85%
Percentage glass area (total)			78.56%	76.58%

Where a *Uw* 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*

	L_f^{2D} W/(m·K)	b_f (mm)	L_ψ^{2D} W/(m·K)	b_g (mm)
F1 fixed sill	0.2026	190	0.2074	190
F2 fixed head	0.2026	190	0.2074	190
F3 fixed jamb	0.2026	190	0.2074	190
F4 + F5 sash sill	0.3006	190	0.3033	190
F6 + F7 sash head	0.3006	190	0.3033	190
F8 + F9 sash jamb	0.3006	190	0.3033	190
F10 + F11 mullion	0.4594	380	0.4647	380

Frame:

Section	Frame width, b_f (m)	Frame U-value, U_f (W/(m²·K))	Frame areas, 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 fixed sill	0.0410	1.6933	0.0238	0.0402	0.0284	0.5500	0.0156
F2 fixed head	0.0410	1.6933	0.0238	0.0402	0.0284	0.5500	0.0156
F3 fixed jamb	0.0410	1.6933	0.0590	0.0999	0.0284	1.4040	0.0398
F4 + F5 sash sill	0.0650	2.5761	0.0362	0.0934	0.0262	0.4960	0.0130
F6 + F7 sash head	0.0650	2.5761	0.0362	0.0934	0.0262	0.4960	0.0130
F8 + F9 sash jamb	0.0650	2.5761	0.0920	0.2369	0.0262	1.3500	0.0354
F10 + F11 mullion	0.0840	2.2994	0.1193	0.2744	0.0523	1.3770	0.0720
		Totals	0.3903	0.8784		Total	0.2044

Solar Factor, *g*-value:

F_w	0.9	
g_w	0.43	

Other parameters needed for calculation, taken from simulations:

λ_p =	0.035	W/(m·K)	R_{se} =	0.04	m²·K/W	$d_p = d_g$ =	0.044	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)

U_{window}			W/(m²·K)
	No bars; or attached bars	1.05	
	Single cross bar in IGU	1.1	
	Multiple cross bar in IGU	1.2	
	Glazing bar (Georgian bar)	1.4	

Air Leakage loss:
Air leakage at 50 Pa per hour & per unit length of opening light (BS 6375-1) - *2DP*: 0.22 m³/(m·h)

Opening light length	3.8840	m	Total air leakage	0.854	m³/h
L_{50}	0.47	m³/(m²·h)	Heat loss = 0.0165 L_{50}	0.01	W/(m²·K)

Energy Window
Energy Index
21
Window Rating
A++

BFRC Rating kWh/(m²·yr)

≥20	A++	✓
>10 to 20	A+	
0 to <10	A	
-10 to <0	B	
-20 to <-10	C	
-30 to <-20	D	
-50 to <-30	E	

BFRC Rating =
218.6g_{window} - 68.5 x (U_{window} + Effective L_{50}) = 20.96
Climate zone is: UK

Thermal transmittance, W/(m²·K)	U_{window}	1.0
Solar factor	g_{window}	0.43
Window air leakage heat loss, W/(m²·K)	L_{factor}	0.01

Simulator Name: David Macía Arias

BFRC Certified Simulator No **S158**

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