THERMAL REPORT IN ACCORDANCE WITH BFRC GUIDELINES AND REGULATIONS

REPORT INFORMATION

Report Nº:	S158/20230221/002
Report Date:	21/02/2023
Simulator:	*David Macía Arias*
Signature	

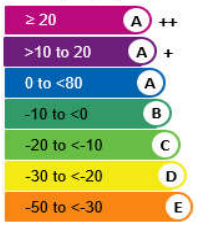
WINDOW SYSTEM SPECIFICATION

Manufacturer:	CORTIZO
System:	COR-4700
Type of Opening:	SLIDING PATIO DOOR
Air lLeakage Details:	
Test Report	**Result Air permeability at 50 Pa**
APPLUS 17/14816-1441 M1	0.94

GLAZING SPECIFICATION

Manufacturer:	SAINT-GOBAIN
Composition:	4 Diamant (12 Argon 90%) 4 Planitherm Total + FG (12 Argon 90%) 4 ECLAZ
Thickness:	36 mm
Solar Factor: (according BS EN 410)	0.62 (62%)
Ug centre value: (according BS EN 673)	0.74 W/m2K

THERMAL PERFORMANCE



Thermal Transmittance (Uw)	1.42
Solar Factor	0.42
Windows air leakage heat loss	0.04
Climate zone ✓	UK
Energy Index	-8.88
WER (Band/ rating)	B

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
15.910 – Padrón (A Coruña)
SPAIN.
Telephone: +34 981 80 42 13
www.cortizo.com

BFRC Certified Simulator No S158

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
PA 66 25 GF H.E. HITEP	Report nº22.049 (CSIC / IETCC)	0.190	0.90
PANEL	BS EN ISO 10077-2	0.035	0.90
POLNA 30FR	Report nº21/25508-1444 (APPLUS)	0.036	0.90
PILE WEATHER STRIPPING	BS EN ISO 10077-2	0.140	0.09
POLYPROPYLENE	BS EN ISO 10077-2	0.220	0.09
STEEL	BS EN ISO 10077-2	50.000	0.09
STAINLES STEEL	BS EN ISO 10077-2	17.000	0.09
PVCr	BS EN ISO 10077-2	0.170	0.90

AIR LEAKAGE REPORT - APPLUS 21/32305407

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

Informe de ensayo número: **17/14816-1441 M1** Página 7

Presión Total	Permeabilidad al Aire MEDIA respecto a la superficie	Clase	Permeabilidad al Aire MEDIA respecto a la Longitud de Juntas	Clase
Nominal (Pa)	m³/h · m²		m³/h · m	
50	2,32	CLASE 3	0,94	CLASE 3

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	12	4.0	12	4
Normal emissivity		0.89 / 0.05		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	$(m^2 \cdot K)/W$

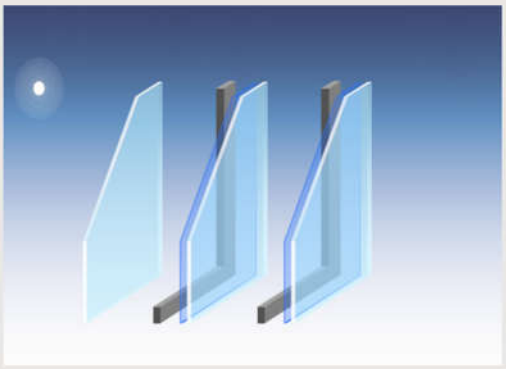
Iteration number	U value	$\sum 1/h_s$	λeff	ΔT	λeff	ΔT
	W/(m²·K)	(m²·K)/W	W/(mK)		W/(mK)	
1	0.741	1.16791	0.0213	7.5	0.0199	7.5
2	0.741	1.16791	0.0213	7.25	0.0199	7.75

GLASS DATA SHEET (Part1 :EN 410)

CORTIZO

SAINT-GOBAIN

CalumenLive
Monday, February 20, 2023



Glazing 1	DIAMANT 4 mm
Cavity 1	Argon 90% 12 mm
Glazing 2	PLANITHERM TOTAL+ FG PLANICLEAR 4 mm
Cavity 2	Argon 90% 12 mm
Glazing 3	ECLAZ PLANICLEAR 4 mm

Last name: David Macía Arias
Country: Spain

Notes:

LUMINOUS FACTORS — EN410 (2011-04)

Light Transmittance (TL)	73 %
Outdoor Reflectance (RLe)	16 %
Indoor Reflectance (RLi)	16 %

THERMAL TRANSMISSION — EN673-2011

Ug	0.7 W/(m².K)
Angle relative to the vertical	0 °

MANUFACTURING SIZES

Nominal Thickness	36.00 mm
Weight	30.0 kg/m²

ACOUSTICS — EN 12758

Acoustic values according to EN 12758 and from notified body

Rw (C;Ctr)	32 (-1; -5) dB
STC (ASTM E413)	N/A
OITC (ASTM E1332)	N/A

SAFETY CLASS — EN 12600

Pendulum Body Resistance	NPD

ENERGY FACTORS — EN410 (2011-04)

Transmittance (TE)	52 %
Outdoor Reflectance (Ree)	28 %
Indoor Reflectance (Rei)	27 %
Absorptance A1 (AE1)	3 %
Absorptance A2 (AE2)	12 %
Absorptance A3 (AE3)	5 %

SOLAR FACTORS — EN410 (2011-04)

Solar Factor (g)	0.62
Shading Coefficient (SC)	0.72

COLOR RENDERING

Transmission (Ra)	98
Reflection (Ra)	91

ANTI-BURGLARY — EN 356

Burglar Resistance	NPD

CARBON FOOTPRINT — EN 15804+A2 (2019)

Global Warming Potential (GWP) (kg. CO_2 equiv/m²) European average (A1-A3)	52

Calumen 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 11923R-11-33705). 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.

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

CORTIZO

SAINT-GOBAIN

DECLARATION OF PERFORMANCE

CE

Saint-Gobain Building Glass Europe

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

EN 1096-4 - Coated glass
intended to be used in buildings and construction works

PLANITHERM TOTAL + FG 4 mm
M107762

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	A1
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
Wind, snow, permanent and imposed load resistance (N/mm^2)	4	45
For uses relating to noise reduction		
Direct airborne sound insulation (dB)	3	30(-2;-2)
For uses relating to energy conservation		
Emissivity ε_4	3	0.05
U-value ($W/(m^2.K)$)	3	NPD
Light transmittance τ_v	3	0.87
Light reflectance ρ_v/ρ'_v	3	0.07/0.06
Solar direct transmittance τ_e	3	0.69
Solar direct reflectance	3	0.17/0.19
g-value	3	0.71
Durability	3	C

F2=PLANITHERM TOTAL + FG

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 — International Product Strategy Director Building Glass

31/08/2022 — Courbevoie - France

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

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 8021215301). 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.

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

BF

RAL GÜTEZEICHEN MEHRSCHEIBEN ISOLIERGLAS

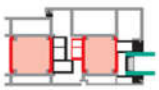
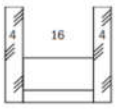
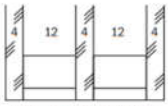
Data sheet Psi values for windows

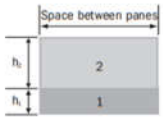
based on determination of the equivalent thermal conductivity of spacers by measurement

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

		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

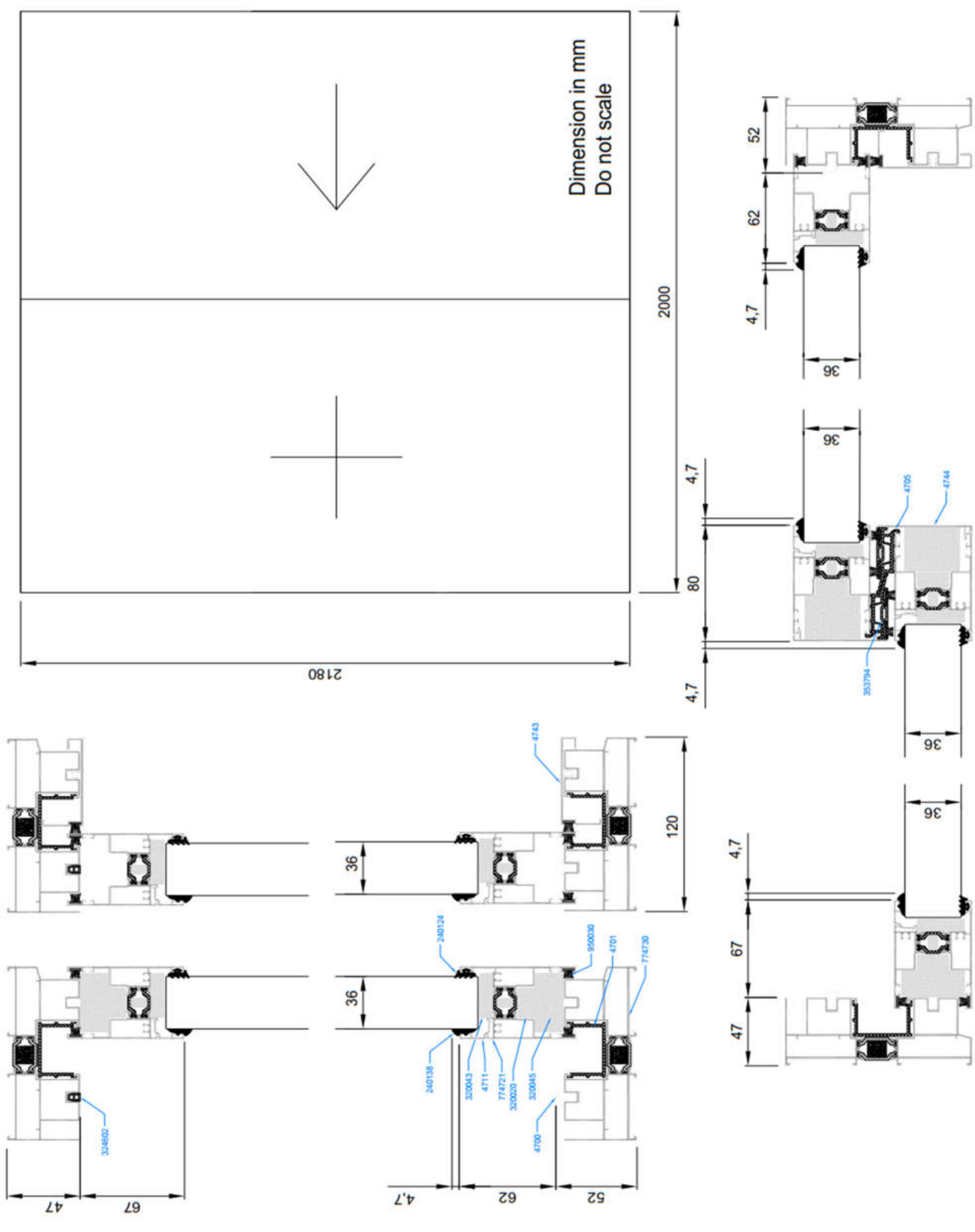
Explanations

The equivalent thermal conductivity has been determined in accordance with the ift guideline WA-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:

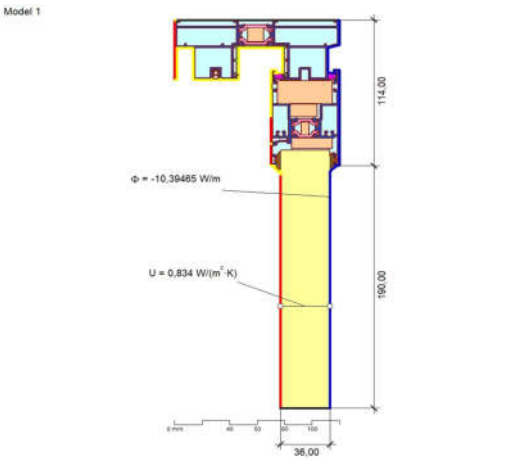
ift ROSENHEIM

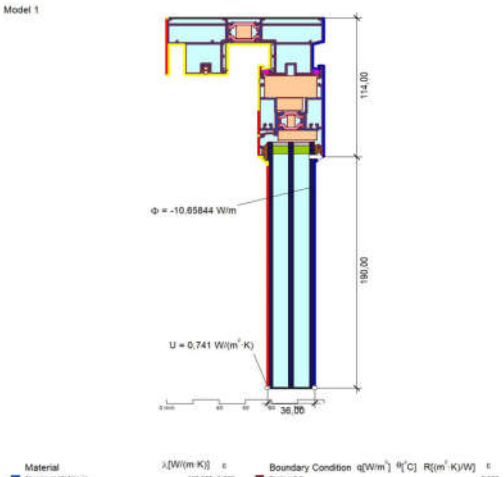
DRAWINGS


Dimension in mm
Do not scale
2000
2180
52
62
4,7
36
80
120
67
47
4705
4744
353794
4743
240124
950030
4701
774730
240138
320043
4711
774721
320020
320045
4700
324602

L2D VALUES (BS EN 10077-2)

SECTION F1 - F2 / F3-F4

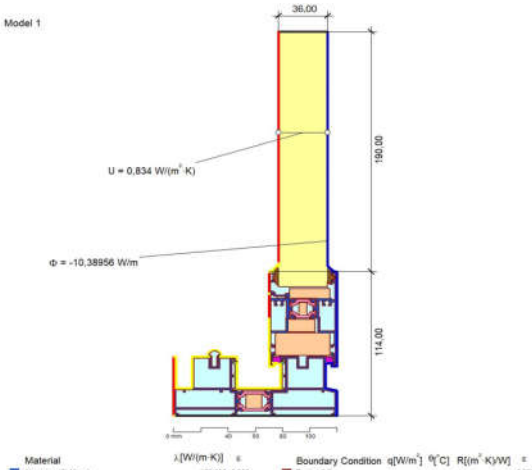


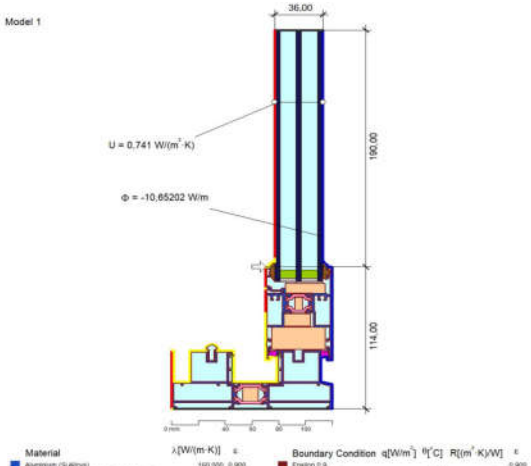


$$U_f = \frac{10,395}{20,000} - 0,834 \cdot 0,190 \over 0,114 = 3,1685\ W/(m^2 \cdot K)$$

$$\Psi_{sd} = \frac{10,658}{20,000} - 0,741 \cdot 0,190 - 3,169 \cdot 0,114 = 0,03092\ W/(m \cdot K)$$

SECTION F5-F6



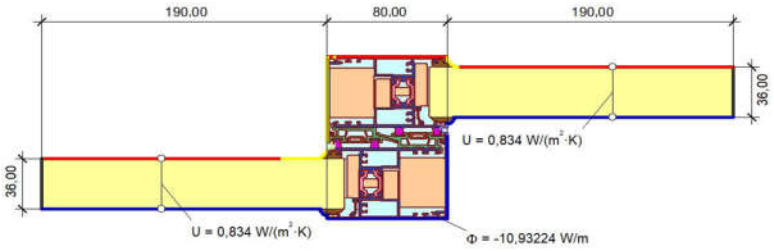


$$U_f = \frac{10,390}{20,000} - 0,834 \cdot 0,190 \over 0,114 = 3,1663\ W/(m^2 \cdot K)$$

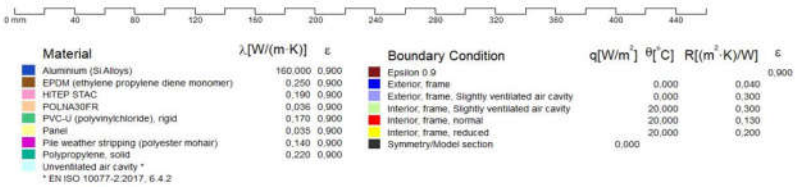
$$\Psi_{sd} = \frac{10,652}{20,000} - 0,741 \cdot 0,190 - 3,166 \cdot 0,114 = 0,03088\ W/(m \cdot K)$$

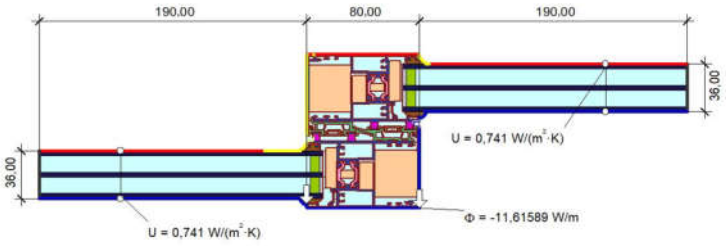
L2D VALUES (BS EN 10077-2)

SECTION F7

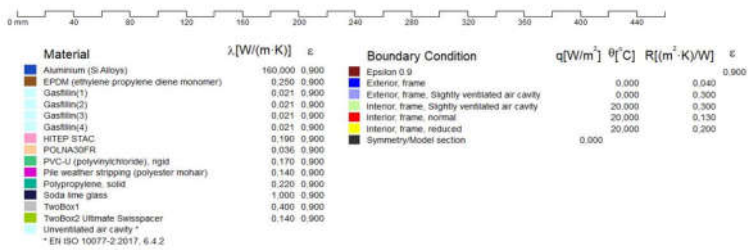


$$U_i = \frac{\frac{10,932}{20,000} - 0,834 \cdot 0,190 - 0,834 \cdot 0,190}{0,080} = 2,8696 \text{ W/(m}^2\text{·K)}$$



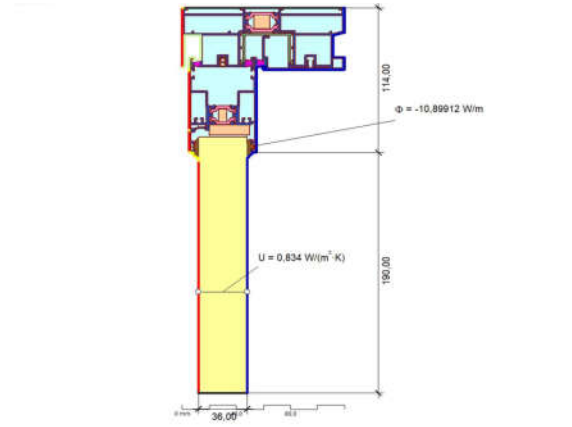


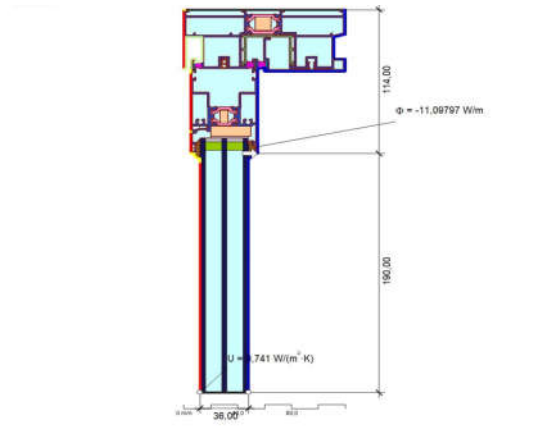
$$\Psi_{eq.} = \frac{\frac{11,616}{20,000} - 0,741 \cdot 0,190 - 2,870 \cdot 0,080 - 0,741 \cdot 0,190}{2} = 0,03482 \text{ W/(m·K)}$$



L2D VALUES (BS EN 10077-2)

SECTION F8-F9/F10-F11

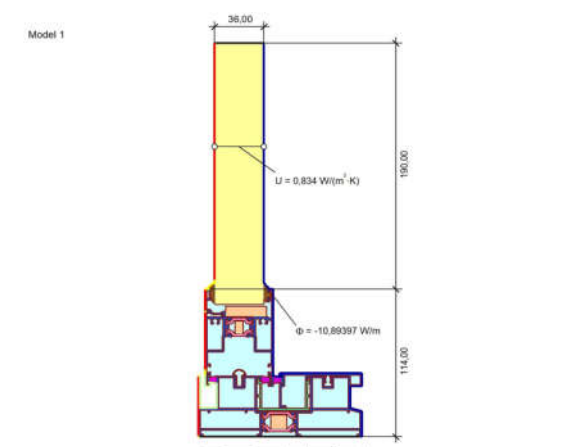


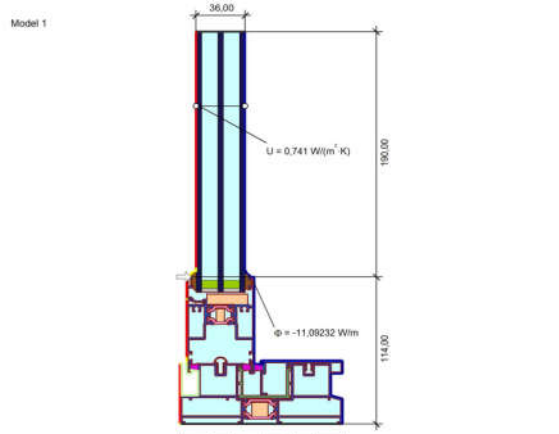


$$U_f = \frac{10,899 - 0,834 \cdot 0,190}{0,114} = 3,3898\ W/(m^2 \cdot K)$$

$$\Psi_{wi} = \frac{11,098}{20,000} - 0,741 \cdot 0,190 - 3,390 \cdot 0,114 = 0,02767\ W/(m \cdot K)$$

SECTION F12-F13



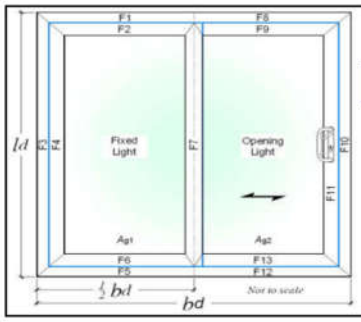


$$U_f = \frac{10,894}{20,000} - \frac{0,834 \cdot 0,190}{0,114} = 3,3875\ W/(m^2 \cdot K)$$

$$\Psi_{wi} = \frac{11,092}{20,000} - 0,741 \cdot 0,190 - 3,388 \cdot 0,114 = 0,02765\ W/(m \cdot K)$$

BFRC CALCULATION SHEET

CORTIZO



Sample Style: **Patio Door**

Blue line illustrates opening light length (air leakage)

Report Number: S158/20230221/002 Issue 2.7: 04/01/2016
Report Date: 21 February 2023
Project Details: COR-4700

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

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_d	2180	mm
Total door width *0DP*	b_d	2000	mm

Frame offset: **No**

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

Glazing dimensions and properties:		
Thickness of pane 1	4	mm
Pane 1/2 distance	12	mm
Gas fill (1/2)	Argon 90%	
Thickness of pane 2	4	mm
Complete next 3 cells for TG IGU		
Pane 2/3 distance	12	mm
Gas fill (2/3)	Argon 90%	
Thickness of pane 3	4.0	mm
Glazing Trans. - *3DP* U_g	0.741	W/(m²·K)
g-value - *2DP* $g_\perp$	0.62	

Thermal transmittance of door from hot box test
$U_{d\text{ - }2dp}$ — W/(m²·K)

Door Dimensions:	Length (m)	Width (m)	Area No gasket (m²)	Area With gasket (m²)
Left Fixed Light	1.9520	0.8460	1.6514	1.6252
Right Opening light	1.9520	0.8460	1.6514	1.6252
Total glazing, A_g			3.3028	3.2504
Frame	(m)	(m)	(m²)	(m²)
F1	1.0000	0.0470	0.0459	0.0459
F2	0.9530	0.0670	0.0603	0.0642
F3	2.1800	0.0470	0.1001	0.1001
F4	2.0810	0.0670	0.1351	0.1443
F5	1.0000	0.0520	0.0508	0.0508
F6	0.9530	0.0620	0.0558	0.0597
F7	2.0810	0.0800	0.1613	0.1796
F8	1.0000	0.0470	0.0459	0.0459
F9	0.9530	0.0670	0.0603	0.0642
F10	2.1800	0.0470	0.1001	0.1001
F11	2.0810	0.0670	0.1351	0.1443
F12	1.0000	0.0520	0.0508	0.0508
F13	0.9530	0.0620	0.0558	0.0597
Total Frame			1.0572	1.1096
Total door, A_t			4.3600	4.3600
Percentage left light glass area			37.88%	37.27%
Percentage right light glass area			37.88%	37.27%
Percentage glass area (total)			75.75%	74.55%
Solar Factor, *g*-value:			F_d	0.9
			g_d	0.42

Frame dimensions: All frame values to nearest 1mm, gaskets to 1DP	Frame heights, (b_f)	Without gasket (mm)	Gasket protrusion (mm)	With gasket (mm)	Total (mm)
F1 + F2 left head rail	F1 left fixed head	47	n/a	47.0	118.7
	F2 left opening head	67	4.7	71.7	
F3 + F4 left jamb	F3 left fixed jamb	47	n/a	47.0	118.7
	F4 left opening jamb	67	4.7	71.7	
F5 +F6 left threshold	F5 left fixed threshold	52	n/a	52.0	118.7
	F6 left opening threshold	62	4.7	66.7	
F7 Meeting Stile	F7 Meeting Stile	80	4.7	89.4	
			4.7		
F8 + F9 right head rail	F8 right fixed head	47	n/a	47.0	118.7
	F9 right opening head	67	4.7	71.7	
F10 + F11 right jamb	F10 right fixed jamb	47	n/a	47.0	118.7
	F11 right opening jamb	67	4.7	71.7	
F12 + F13 right threshold	F12 right fixed threshold	52	n/a	52.0	118.7
	F13 right opening threshold	62	4.7	66.7	
	Total gasket area		0.0524257	m^2	

Where a U_d 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_f (mm)
F1 + F2 left head rail	0.5197	190	0.5329	190
F3 + F4 left jamb	0.5197	190	0.5329	190
F5 +F6 left threshold	0.5195	190	0.5326	190
F7 Meeting Stile	0.5466	380	0.5808	380
F8 + F9 right head rail	0.5450	190	0.5549	190
F10 + F11 right jamb	0.5450	190	0.5549	190
F12 + F13 right threshold	0.5447	190	0.5546	190

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 left head rail	0.1140	3.1685	0.1062	0.3364	0.0309	0.8460	0.0262
F3 + F4 left jamb	0.1140	3.1685	0.2352	0.7454	0.0309	1.9520	0.0604
F5 +F6 left threshold	0.1140	3.1663	0.1065	0.3374	0.0309	0.8460	0.0261
F7 Meeting Stile	0.0800	2.8696	0.1613	0.4629	0.0696	1.9520	0.1360
F8 + F9 right head rail	0.1140	3.3898	0.1062	0.3599	0.0277	0.8460	0.0234
F10 + F11 right jamb	0.1140	3.3898	0.2352	0.7974	0.0277	1.9520	0.0540
F12 + F13 right threshold	0.1140	3.3875	0.1065	0.3609	0.0276	0.8460	0.0234
		Totals	1.0572	3.4002		Total	0.3494

Other parameters needed for calculation, taken from simulations:
λ_p = 0.035 W/(m·K) R_{se} = 0.04 m²·K/W $d_p = d_g$ = 0.036 m
R_p = 1.0286 m²·K/W R_{tot} = 1.1986 m²·K/W R_{se} = 0.13 m²·K/W
U_p = 0.8343 W/(m²·K)

U_{door}		
No bars; or attached bars	1.42	W/(m²·K)
Single cross bar in IGU	1.5	
Multiple cross bar in IGU	1.6	
Glazing bar (Georgian bar)	1.8	

Air Leakage loss:
Air leakage at 50 Pa per hour & per unit length of opening light (BS 6375-1) - *2DP* 0.94 m³/(m·h)
Opening light length 10.0550 m — Total air leakage 9.452 m³/h
L_{50} 2.17 m³/(m²·h) — Heat loss = 0.0165 L_{50} 0.04 W/(m²·K)

Energy Door
Energy Index
-9
Door Rating
B

BFRC Rating kWh/(m²·yr)

≥ 20	A++
>10 to 20	A+
0 to <80	A
-10 to <0	B ✓
-20 to <-10	C
-30 to <-20	D
-50 to <-30	E

BFRC Rating =
218.6g_d - 68.5 x (U_d + Effective L_{50}) = -8.88
Climate zone is: UK

Thermal transmittance, W/(m²·K)	U_{door}	1.4
Solar factor	g_{door}	0.42
Door air leakage heat loss, W/(m²·K)	L_{factor}	0.04

Simulator Name: David Macia Arias

BFRC Certified Simulator No **S158**