

**THERMAL REPORT IN ACCORDANCE WITH  
BFRC GUIDELINES AND REGULATIONS**



**REPORT INFORMATION**

Report N°:	S158/20221018/001
Report Date:	18/10/2022
Simulator:	David Macía Arias
Signature	

**WINDOW SYSTEM SPECIFICATION**

Manufacturer:	CORTIZO
System:	Cortizo Bi-Fold System
Type of Opening:	Bi-Fold
<b>Air Leakage Details:</b>	
Test Report	Result Air permeability at 50 Pa
EXOVA - WIL389717	0.46 m3/(hm)

**GLAZING SPECIFICATION**

Manufacturer:	Saint-Gobain
Composition:	4 Diamant (20 Argon 90%) 4 Planitherm Total + FG
Thickness:	28 mm
Solar Factor: (according BS EN 410)	75 (75%)
Ug centre value: (according BS EN 673)	1.22 W/m2K

**THERMAL PERFORMANCE**

<b>BFRC Rating</b> <small>kWh/(m<sup>2</sup>-yr)</small> 	Thermal Transmittance (U <sub>w</sub> )	1.76
	Solar Factor (g <sub>w</sub> )	0.48
	Windows air leakage heat loss	0.02
	Climate zone	UK
	Energy Index	-15.88
	WER (Band/ rating)	C

**SPACE BAR SPECIFICATION**

Reference:	W19-SWISSPACER ULTIMATE
Ref. data source:	BF- W19 datasheet April-2013
<b>Secondary Sealant</b>	
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



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 Lugar de Extramundi, S/N  
 15.910 – Padrón (A Coruña)  
 SPAIN.  
 Telephone: +34 981 80 42 13  
[www.cortizo.com](http://www.cortizo.com)



# THERMAL CONDUCTIVITY VALUES



MATERIAL	STANDARD OR SOURCE	CONDUCTIVITY W/(mK)	EMISSIVITY
Aluminium (Si Alloys)	BS EN ISO 10077-2	160.000	0.90
Aluminium (Si Alloys)	BS EN ISO 10077-2	160.000	0.10
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 n°21/25508-1444 (APPLUS)	0.036	0.90
Stainless steel	BS EN ISO 10077-2	0.030	0.90

## AIR LEAKAGE REPORT - EXOVA WIL389717

The following results were achieved:

Product tested	Cortizo Bi-Fold Doorset		
Summary of testing procedure			Result
	Test Standard	Classification Standard	
Air permeability	BS EN 1026: 2000	BS EN 12207: 2000	600Pa (Class 4) *
Watertightness	BS EN 1027: 2000	BS EN 12208: 2000	600Pa (Class 9A) *
Wind resistance	BS EN 12211: 2000	BS EN 12210: 2000	1200Pa (Class A3) *
Exposure category		BS 6375: Part 1: 2009	1200

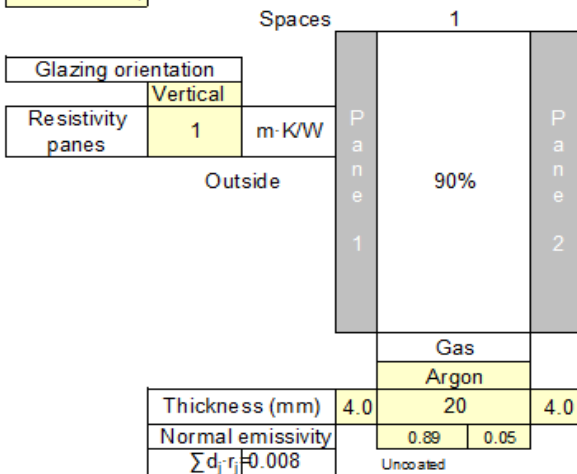
Air leakage at 50pa was 3.09m³/h positive pressure and 3.16m³/h negative pressure. The perimeter length of opening light was 6.75m.

The results relate only to the specimen tested, as detailed in the technical specification  
\* performance assessed from Debar report BMT/MTP/F15279/02

## BS EN 673 CALCULATION

Version 12 18/06/2015. Calculations according to BS EN 673:2011

Number of spaces	1
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For uncoated surfaces input 0.89 for normal emissivity, which corresponds to a corrected emissivity of 0.837

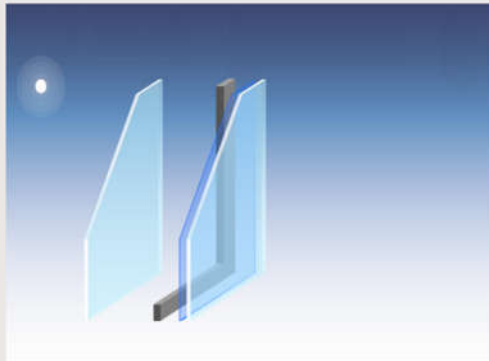
External, $R_{se}$	0.04	(m²·K)/W
Internal, $R_{si}$	0.13	(m²·K)/W
Iteration number	U value	$\sum 1/h_s$
	W/(m²·K)	(m²·K)/W
1	1.219	0.64228
2	1.219	0.64228

$\lambda_{eff}$	$\Delta T$
W/(mK)	
0.0311	15
0.0311	15

# GLASS DATA SHEET (Part1 :EN 410)



CalumenLive  
Tuesday, June 7, 2022



Glazing 1	DIAMANT 4 mm
Cavity 1	Argon 90% 20 mm
Glazing 2	PLANITHERM TOTAL+ FG PLANICLEAR 4 mm

Last name: David Macía Arias  
Country: Spain

Notes:

## LUMINOUS FACTORS

EN410 (2011-04)

Light Transmittance (TL)	80 %
Outdoor Reflectance (RLe)	13 %
Indoor Reflectance (RLi)	12 %



## THERMAL TRANSMISSION

EN673-2011

Ug	1.2 W/(m².K)
Angle relative to the vertical	0 °



## MANUFACTURING SIZES

Nominal Thickness	28.00 mm
Weight	20.0 kg/m²



## ACOUSTICS

EN 12758

<i>Acoustic simulated values</i>	
Rw (C;Ctr)	33 (-1; -5) dB
STC (ASTM E413)	34
OITC (ASTM E1332)	26



## SAFETY CLASS

EN 12600

Pendulum Body Resistance	NPD
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## ENERGY FACTORS

EN410 (2011-04)

Transmittance (TE)	66 %
Outdoor Reflectance (Ree)	21 %
Indoor Reflectance (Rei)	21 %
Absorptance A1 (AE1)	3 %
Absorptance A2 (AE2)	10 %



## SOLAR FACTORS

EN410 (2011-04)

Solar Factor (g)	0.75
Shading Coefficient (SC)	0.86



## COLOR RENDERING

Transmission (Ra)	99
Reflection (Ra)	90



## ANTI-BURGLARY

EN 356

Burglar Resistance	NPD
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## CARBON FOOTPRINT

EN 15804+A2

Global Warming Potential (GWP) (kg. CO <sub>2</sub> equiv/m²) European average	34.68
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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)**



**DECLARATION OF PERFORMANCE**



**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
<b>For uses relating to safety in case of fire:</b>		
Resistance to fire	1	NPD
Reaction to fire	3,4	A1
External fire performance	3,4	NPD
<b>For uses as anti-bullet or anti-explosion glazing</b>		
Bullet resistance	1	NPD
Explosion resistance	1	NPD
<b>For uses liable to present "safety-in-use" risks and subject to such regulations</b>		
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 <sup>2</sup> )	4	45
<b>For uses relating to noise reduction</b>		
Direct airborne sound insulation (dB)	3	30(-2;-2)
<b>For uses relating to energy conservation</b>		
Emissivity $\epsilon_g$	3	0.05
U-value (W/(m <sup>2</sup> .K))	3	NPD
Light transmittance $\tau_v$	3	0.87
Light reflectance $\rho_v/\rho'_v$	3	0.07/0.06
Solar direct transmittance $\tau_s$	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

# WARM EDGE WORKING PARTY DATA SHEET - BF



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

'WARM EDGE' WORKING PARTY



## 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

Profile description		Spacer height in mm	Material Metalized multilayer polyester film "High Tech Gas Barrier Foll"/ SAN-GF	Thickness d in mm ~0.05 1.0
		Spacer category C		

Representative glass constructions	Metal with thermal break	Plastic	Wood	Wood/Metal
<p>Double-sheet insulating glass <math>U_g = 1.1</math> W/m<sup>2</sup>K</p>				
0.036	0.032	0.031	0.032	
<p>Triple-sheet insulating glass <math>U_g = 0.7</math> W/m<sup>2</sup>K</p>				
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
Can be used for all spacer widths		0.40	0.14

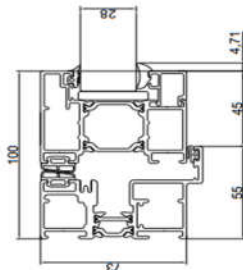
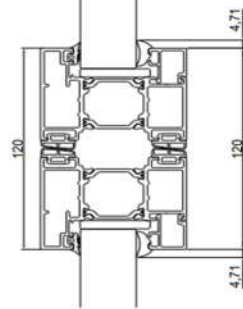
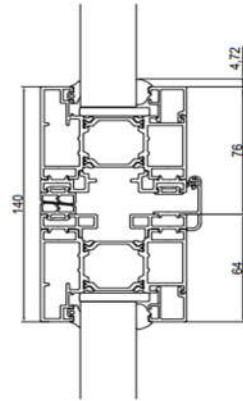
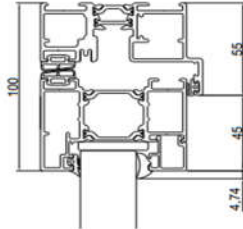
#### Explanations

The equivalent thermal conductivity has been determined in accordance with the ift guideline WA-17eng/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-08eng/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  $\pm 0.003$  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:

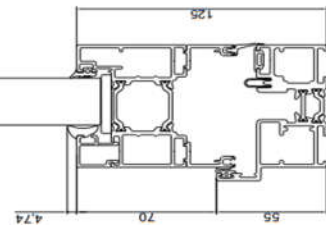
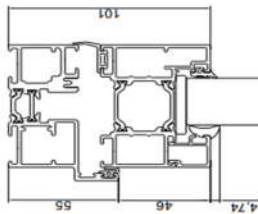
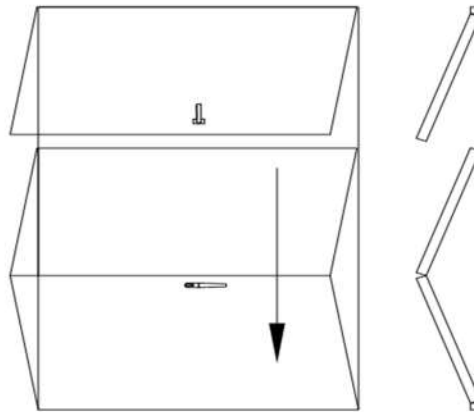


# DRAWINGS



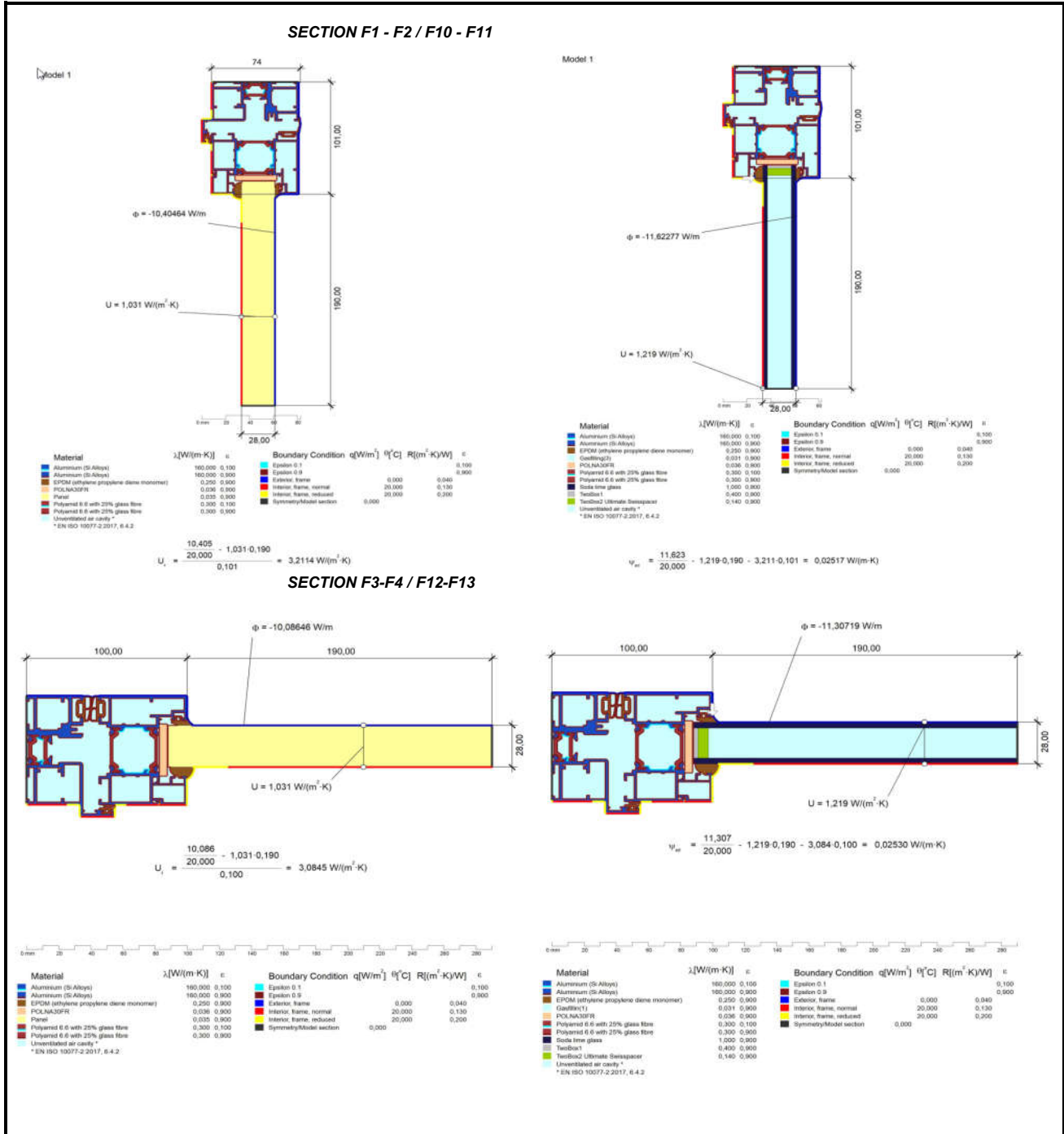
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	240136
	287300
	353769
	353765
	353766
	353767
	393767
	222401
	353794

	COR-3730
	COR-3721
	COR-3725
	COR-3780
	COR-3745
	COR-4503
	COR-3743
	COR-3744

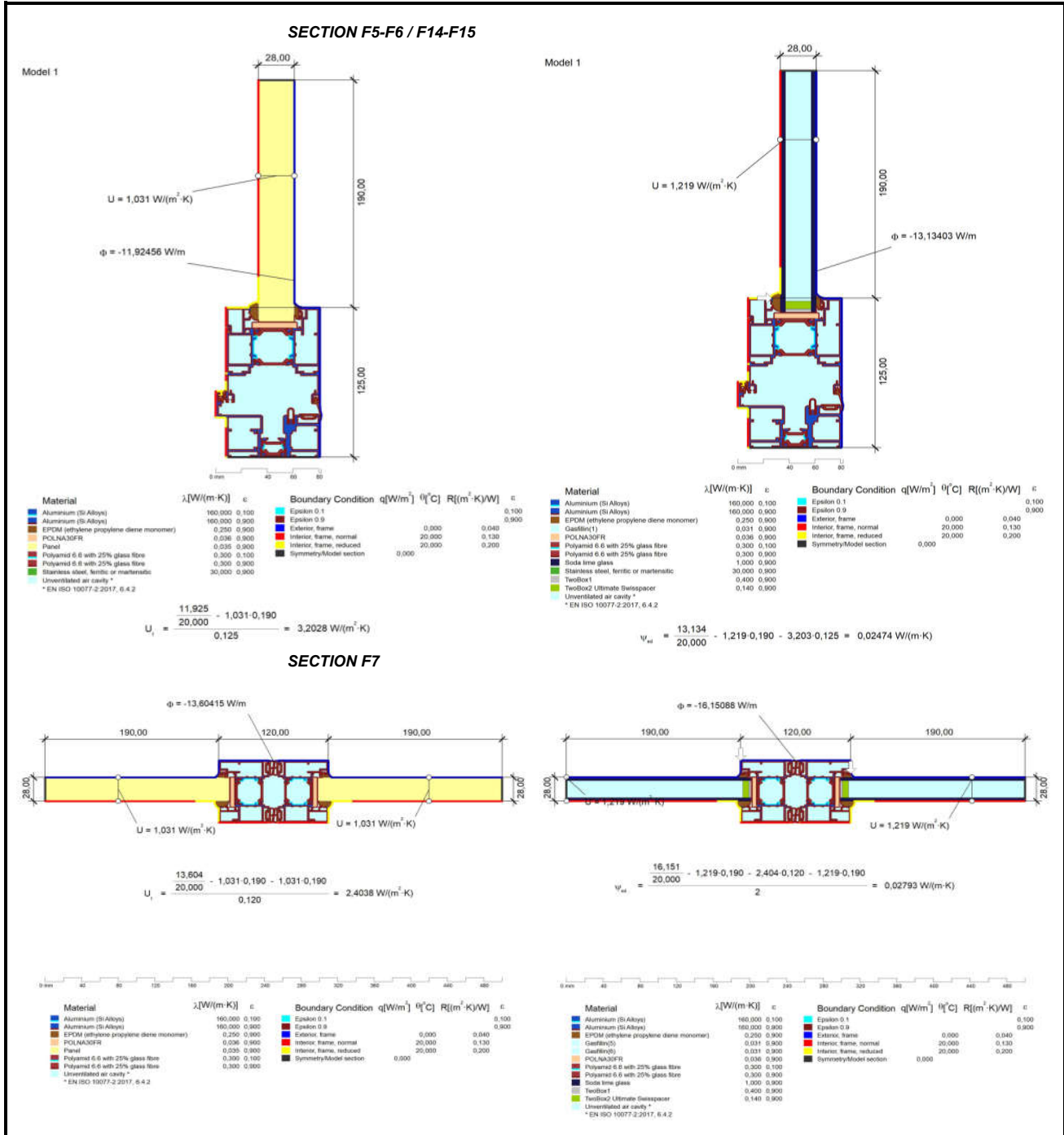


DO NOT SCALE  
All dimensions are in mm.

# L2D VALUES (BS EN 10077-2)



# L2D VALUES (BS EN 10077-2)

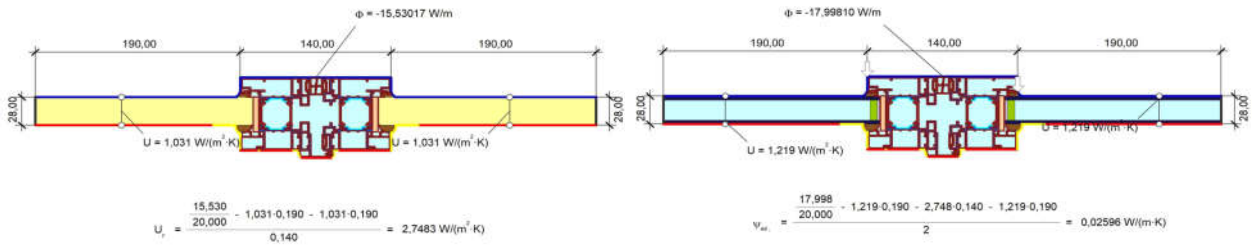




# L2D VALUES (BS EN 10077-2)



## SECTION F8-F9



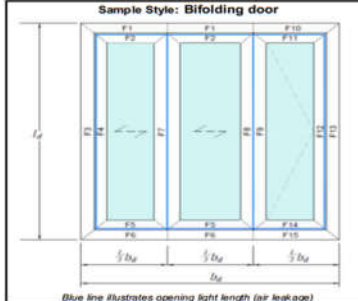
Material	$\lambda$ [W/(m·K)]	$\epsilon$	Boundary Condition	$q$ [W/m <sup>2</sup> ]	$t$ [°C]	$R$ [m <sup>2</sup> ·K/W]	$\epsilon$
Aluminium (Si Alloys)	160,000	0,100	Epsilon 0.1			0,100	0,100
Aluminium (Si Alloys)	180,000	0,000	Epsilon 0.9			0,000	0,000
EPDM (ethylene propylene diene monomer)	0,200	0,900	Exterior frame			0,040	0,040
POLNA3DFH	0,036	0,900	Interior frame, normal	20,000		0,130	0,130
Panel	0,036	0,900	Interior frame, reduced	20,000		0,200	0,200
Polyamid 6.6 with 25% glass fibre	0,300	0,100	Symmetry/Model section	0,000		0,000	0,000
Polyamid 6.6 with 25% glass fibre	0,300	0,000					
Unventilated air cavity*							

\* EN ISO 10077-2:2017, 6.4.2

Material	$\lambda$ [W/(m·K)]	$\epsilon$	Boundary Condition	$q$ [W/m <sup>2</sup> ]	$t$ [°C]	$R$ [m <sup>2</sup> ·K/W]	$\epsilon$
Aluminium (Si Alloys)	160,000	0,100	Epsilon 0.1			0,100	0,100
Aluminium (Si Alloys)	180,000	0,000	Epsilon 0.9			0,000	0,000
EPDM (ethylene propylene diene monomer)	0,200	0,900	Exterior frame			0,040	0,040
GasA (2)	0,031	0,900	Interior frame, normal	20,000		0,130	0,130
GasB (2)	0,031	0,900	Interior frame, reduced	20,000		0,200	0,200
POLNA3DFH	0,036	0,900	Symmetry/Model section	0,000		0,000	0,000
Polyamid 6.6 with 25% glass fibre	0,300	0,100					
Polyamid 6.6 with 25% glass fibre	0,300	0,000					
Soda lime glass	1,000	0,900					
TecBox1	0,400	0,900					
TecBox2 Ultimate Spacers	0,140	0,900					
Unventilated air cavity*							

\* EN ISO 10077-2:2017, 6.4.2

# BFRC CALCULATION SHEET



Report Number: S158/20221018/001 Issue 2.3: 04/01/2016  
 Report Date: 18 October 2022  
 Project Details: CORTIZO BIFOLD SYSTEM - DOUBLE GLAZING

**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 GDP	$L_d$	2190 mm
Total door width GDP	$B_d$	2500 mm

Frame dimensions: All frame values to nearest mm, gaskets to nearest 0.1mm		Frame height, $b_f$ (mm)	Gasket protrusion, $b_g$ (mm)	Frame with gasket (mm)	Total frame (mm)
F1 + F2 L&M head rail	F1 left fixed head	55	n/a	55.0	101
	F2 right opening head	46	4.7	50.7	
F3 + F4 left jamb	F3 left fixed jamb	55	n/a	55.0	100
	F4 right opening jamb	45	4.7	49.7	
F5 + F6 L&M threshold	F5 left opening threshold	70	4.7	74.7	125
	F6 right fixed threshold	55	n/a	55.0	
F7 Meeting Sill	F7 Meeting Sill	120	4.7	129.4	
F8 + F9 Meeting stile	F8 bi-fold opener	64	4.7	68.7	140
	F9 opener	76	4.7	80.7	
F10 + F11 right head rail	F10 right fixed head	55	n/a	55.0	101
	F11 right opening head	46	4.7	50.7	
F12 + F13 right jamb	F12 right opening jamb	45	4.7	49.7	100
	F13 right fixed jamb	55	n/a	55.0	
F14 + F15 R threshold	F14 right opening threshold	70	4.7	74.7	125
	F15 right fixed threshold	55	n/a	55.0	
Recessed depth F8 & F15				n/a	
Total gasket area				0.0740137	m <sup>2</sup>

Frame offset: **No**

Nominal 4mm etc to GDP, others GDP

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. - GDP	$U_g$	1.219 W/(m <sup>2</sup> *K)
g-value - GDP	$g$	0.75

Thermal transmittance of door from hot box test

$U_{d, GDP}$  W/(m<sup>2</sup>\*K)

Section	Length (m)	Width (m)	Area	
			No gasket (for U-value) (m <sup>2</sup> )	With gasket (for g-value) (m <sup>2</sup> )
Left Sliding light	1.9540	0.6733	1.3157	1.2911
Middle Sliding light	1.9540	0.7093	1.3860	1.3611
Right Opening light	1.9540	0.6573	1.2844	1.2600
Total glazing, $A_g$			3.9862	3.9121
Frame				
F1	1.6667	0.0550	0.0902	0.0902
F2	1.6117	0.0460	0.0689	0.0753
F3	2.1800	0.0550	0.1169	0.1169
F4	2.0700	0.0450	0.0905	0.0997
F5	1.6117	0.0700	0.1048	0.1113
F6	1.6667	0.0550	0.0902	0.0902
F7	2.0700	0.1200	0.2414	0.2598
F8	2.0700	0.0640	0.1288	0.1379
F9	2.0700	0.0760	0.1529	0.1621
F10	0.8333	0.0550	0.0443	0.0443
F11	0.7783	0.0460	0.0330	0.0361
F12	2.0700	0.0450	0.0905	0.0997
F13	2.1800	0.0550	0.1169	0.1169
F14	0.7783	0.0700	0.0502	0.0533
F15	0.8333	0.0550	0.0443	0.0443
Total Frame			1.4638	1.5379
Total door, $A_d$			5.4500	5.4500
Percentage left light glass area			24.14%	23.69%
Percentage middle light glass area			25.43%	24.97%
Percentage right light glass area			23.57%	23.12%
Percentage glass area (total)			73.14%	71.78%

Where a  $U_g$  value from hot box testing is available, no  $L_{e,20}$  or  $L_{e,30}$  values need to be entered

Frame conductance:	All L values to GDP		All b values to GDP	
	$L_{e,20}$	$L_{e,30}$	$W/(m^2 K)$	$b_g$ (mm)
F1 + F2 L&M head rail	0.5202	190	0.5811	190
F3 + F4 left jamb	0.5043	190	0.5654	190
F5 + F6 L&M threshold	0.5962	190	0.6567	190
F7 Meeting Sill	0.6802	380	0.8075	380
F8 + F9 Meeting stile	0.7765	380	0.8999	380
F10 + F11 right head rail	0.5202	190	0.5811	190
F12 + F13 right jamb	0.5043	190	0.5654	190
F14 + F15 R threshold	0.5962	190	0.6567	190

Frame:	Frame width (no gaskets), $b_f$ (m)	Frame U-value, $U_f$ (W/m <sup>2</sup> *K)	Frame area (no gaskets), $A_f$ (m <sup>2</sup> )	Frame heat flow, $H_U$ (W/K)	Linear trans. $\psi$ (W/m K)	Linear length, $l_f$ (m)	Junction heat flow, $H_p$ (W/K)
F1 + F2 L&M head rail	0.1010	3.2114	0.1590	0.5107	0.0252	1.3827	0.0348
F3 + F4 left jamb	0.1000	3.0845	0.2074	0.6398	0.0253	1.9540	0.0494
F5 + F6 L&M threshold	0.1250	3.2028	0.1950	0.6244	0.0247	1.3827	0.0342
F7 Meeting Sill	0.1200	2.4038	0.2414	0.5804	0.0559	1.9540	0.1092
F8 + F9 Meeting stile	0.1400	2.7483	0.2817	0.7741	0.0519	1.9540	0.1015
F10 + F11 right head rail	0.1010	3.2114	0.0773	0.2484	0.0252	0.6573	0.0165
F12 + F13 right jamb	0.1000	3.0845	0.2074	0.6398	0.0253	1.9540	0.0494
F14 + F15 R threshold	0.1250	3.2028	0.0946	0.3029	0.0247	0.6573	0.0163
Totals		1.4638	4.3204			Total	0.4113

Other parameters:

Panel thickness,  $d_p = d_g = 0.028$  m

$\lambda_p = 0.036$  W/(m K)  $R_{sp} = 0.04$  m<sup>2</sup> K/W  $R_{gp} = 0.13$  m<sup>2</sup> K/W

$R_p = 0.8000$  m<sup>2</sup> K/W  $R_{tp} = 0.9700$  m<sup>2</sup> K/W  $U_p = 1.0309$  W/(m<sup>2</sup> K)

Solar Factor, g-value:

$F_d$  0.9

$g_d$  0.48

U<sub>door</sub> W/(m<sup>2</sup> K)

No bars, or attached bars: 1.76

Single cross bar in IGU: 1.9

Multiple cross bar in IGU: 2.0

Glazing bar (Georgian bar): 2.2

Air Leakage loss:

Air leakage at 50 Pa per hour & per unit length of opening light (BS 6375-1) - GDP: 0.46 m<sup>3</sup>/(m h)

Opening light length: 13.0600 m Total air leakage: 6.047 m<sup>3</sup>/h

$L_{50}$  1.11 m<sup>3</sup>/(m<sup>2</sup> h) Heat loss = 0.0165  $L_{50}$  0.02 W/(m<sup>2</sup> K)

Energy Window Energy Index **-16** Window Rating **C**

BFRC Rating kWh/(m<sup>2</sup>·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 = **-15.88**

Climate zone is: **UK**

Thermal transmittance,  $W/(m^2 K)$   $U_{door}$  **1.8**

Solar factor  $g_{door}$  **0.48**

Door air leakage heat loss,  $W/(m^2 K)$   $L_{factor}$  **0.02**

Simulator Name: **David Macia Arias**

BFRC Certified Simulator No **S158**