

Report in Accordance with BFRC Guidelines and Regulations

Product description: “Fabco Sanctuary W20 Doorset”

CONFIDENTIAL

Client:	Fabco Sanctuary Ltd Unit 1 Hobbs New Barn Climping Little Hampton West Sussex BN17 5RE
Project:	W20 Double Leaf Doorset
Project reference:	CU16059-2
Prepared By:	
Issue date:	XX XXXXX 2016

Build Check Ltd
Montrose House,
Lancaster Road,
Cressex Business Park,
High Wycombe,
Bucks, HP12 3PY

Tel: 01494 452713
Fax: 0870 2101013
E-mail: info@buildcheck.co.uk



Approved Simulator 001

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1 Introduction

The U-value calculations of the Fabco Sanctuary W20 doorset detailed below were commissioned by David Cane of Fabco Sanctuary Ltd.

2 Validation of Program

The Therm 5.2 analysis software has been validated against proofs in Annex D (D1 to D10) of BS EN ISO 10077-2:2012.

3 Analysis Method

The frame profile results detailed below are provided by computer simulation using LBL software program THERM 5.2 and BFRG guidelines and regulations.

4 Summary of Results

A summary of results are detailed in the following sections. The details supplied for the analysis as well as all information required to verify the analysis can be found in the attached CD.

4.1 Frame thermal transmittance (following the principles of BS EN ISO 10077-2)

Fabco Sanctuary W20 Frame Profile	Frame Thermal Transmittance (U_f)
Outer Frame	6.3 W/(m ² ·K)
Meeting Stile	6.7 W/(m ² ·K)

4.2 Linear thermal transmittance (following the principles of BS EN ISO 10077-2)

Fabco Sanctuary W20 Frame Profile	Linear Thermal Transmittance (ψ)
Outer Frame	0.053 W/(m·K)
Meeting Stile	0.10 W/(m·K)

4.3 Centre pane U-Value of glazing calculated in accordance with BS EN 673.

Glazing Unit	Centre Pane U-value (U_g)
4-10-4 Low-E 0.05 uncorrected emissivity (Guardian Climaguard A+), 90% Krypton, 10% Air filled, low iron (Guardian UltraClear) glazing unit with Swisspacer Ultimate spacer bar with 3mm polysulfide/polyurethane secondary seal.	1.1 W/(m ² ·K)

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4.4 The thermal performance of the doorsets (U_D) in accordance with BFRC guidelines and regulations:

Fabco Sanctuary W20 Frame Profile	Doorset U-Value
Steel frame system with 4-10-4 Low-E 0.05 uncorrected emissivity (Guardian Climaguard A+), 90% Krypton, 10% Air filled, low iron (Guardian UltraClear) glazing unit with Swisspacer Ultimate spacer bar with 3mm polysulfide/polyurethane secondary seal.	1.9 W/(m ² ·K)

4.5 The Effective L_{50} in accordance with BFRC guidelines and regulations:

Fabco Sanctuary W20 Frame Profile	Effective L_{50}
Air permeability at 50 pa	0.06 W/(m ² ·K)

4.6 Total solar energy transmittance (g) in accordance with EN 410

Fabco Sanctuary W20 Frame Profile	$G_{doorset}$
Steel frame system with 4-10-4 Low-E 0.05 uncorrected emissivity (Guardian Climaguard A+), 90% Krypton, 10% Air filled, low iron (Guardian UltraClear) glazing unit with Swisspacer Ultimate spacer bar with 3mm polysulfide/polyurethane secondary seal.	0.59

5.0 BFRC Rating

5.1 Fabco Sanctuary W20 doorset system

Fabco Sanctuary W20 Frame Profile	Rating
Steel frame system with 4-10-4 Low-E 0.05 uncorrected emissivity (Guardian Climaguard A+), 90% Krypton, 10% Air filled, low iron (Guardian UltraClear) glazing unit with Swisspacer Ultimate spacer bar with 3mm polysulfide/polyurethane secondary seal.	- 9 (Rating Scale B)

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Technical Specification

Profiles	Ref. No.	Material Type/Manufacturer's Name & Density (Timber only)	Dimensions (Height & Width)
Outer Frame	??	Steel - Montanstahl	mm x mm
Meeting Stile	??	Steel - Montanstahl	mm x mm
Sash Vent	??	Steel - Montanstahl	mm x mm
Glazing Bead	N/A	Bedded on Arbo 1096 silicone	-
Joint Type	N/A	N/A	
Joint Adhesives	N/A	N/A	

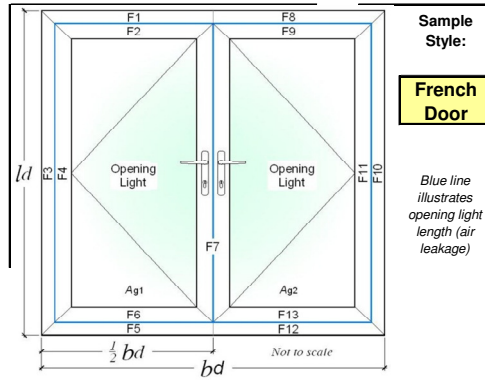
Weather Seals	Ref. No.	Material Type/ Manufacturer's Name	Continuous or Joined @ Corners
Glazing Bead	N/A	N/A	
Glazing Rebate	??	?? - Glazing Tape	
Sash Perimeter Seal	??	?? - EPDM	
Frame Rebate	??	?? - EPDM	

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Glazing Component	Specification
Overall sealed unit: 1. Thickness (mm)	1. 18mm
Outer pane 1. Thickness (mm) 2. Manufacturer 3. Description	1. 4mm 2. Guardian 3. UltraClear
Inner pane: 1. Thickness 2. Manufacturer 3. Description	1. 4mm 2. Guardian 3. Climaguard A+
Spacer bar: 1. Manufacturer 2. Description	1. SGG 2. Swisspacer Ultimate
Cavity 1. Distance (mm) 2. Gas %	1. 10mm 2. Krypton 90% Air 10%
Edge seal 1. Manufacturer 2. Description	1. N/A 2. 3mm polysulfide/polyurethane secondary seal

Additional Notes
<p>Air leakage data is taken from Build Check Test report ref. W16060-1 dated ?date? (data at 50Pa pressure = 1.53).</p> <p>Solar heat gain figures are calculated from g-values supplied by the product manufacturer from EN 410 calculations for the glass units used in this simulation. The value used is 0.75.</p>

BFRC Spreadsheet



Sample Style: **French Door**

Blue line illustrates opening light length (air leakage)

Report Number: **U16059-2** Issue 2.1: 18/07/2013
 Report Date: **17 August 2016**
 Project Details: **W20 steel doorset, Climaguard A+, Krypton, Swisspacer Ultimate**

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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 door height ODP	l_d	2180 mm
Total door width ODP	b_d	2000 mm

Frame offset: No Yes

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

Glazing dimensions and properties:

Thickness of pane 1	4	mm
Pane 1/2 distance	10	mm
Gas fill (1/2)	Krypton 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	1.120 W/(m²·K)
g-value - 2DP	g_i	0.75

Thermal transmittance of door from hot box test

U_d - **2DP** W/(m²·K)

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

Door Dimensions:

Section	Length		Width		Area	
	(m)	(m)	No gasket (m²)	With gasket (m²)	(m²)	(m²)
Left Opening light	2.0680	0.9165	1.8953	1.8953		
Right Opening light	2.0680	0.9165	1.8953	1.8953		
Total glazing, A_g			3.7906	3.7906		
Frame		(m)	(m)	(m²)	(m²)	
F1	1.0000	0.0430	0.0421	0.0421		
F2	0.9570	0.0130	0.0122	0.0122		
F3	2.1800	0.0430	0.0919	0.0919		
F4	2.0940	0.0130	0.0271	0.0271		
F5	1.0000	0.0430	0.0421	0.0421		
F6	0.9570	0.0130	0.0122	0.0122		
F7	2.0940	0.0550	0.1145	0.1145		
F8	1.0000	0.0430	0.0421	0.0421		
F9	0.9570	0.0130	0.0122	0.0122		
F10	2.1800	0.0430	0.0919	0.0919		
F11	2.0940	0.0130	0.0271	0.0271		
F12	1.0000	0.0430	0.0421	0.0421		
F13	0.9570	0.0130	0.0122	0.0122		
Total Frame			0.5694	0.5694		
Total door, A_d			4.3600	4.3600		
Percentage left light glass area			43.47%	43.47%		
Percentage right light glass area			43.47%	43.47%		
Percentage glass area (total)			86.94%	86.94%		
Solar Factor, g-value:			F_d	0.9		
			g_d	0.59		

Frame dimensions: All frame values to nearest 1mm, gaskets to 1DP

	(b _i)	Without gasket	Frame offset	Gasket protrusion	With gasket	Total
		(mm)	(mm)	(mm)	(mm)	
F1 + F2 left head rail	F1 left fixed head	43	n/a	n/a	43.0	56.0
	F2 left opening head	13	2	0.0	13.0	
F3 + F4 left jamb	F3 left fixed jamb	43	n/a	n/a	43.0	56.0
	F4 left opening jamb	13	2	0.0	13.0	
F5 + F6 left threshold	F5 left fixed threshold	43	n/a	n/a	43.0	56.0
	F6 left opening threshold	13	2	0.0	13.0	
F7 Meeting Stile	F7 Meeting Stile	55	2	0.0	55.0	
F8 + F9 right head rail	F8 right fixed head	43	n/a	n/a	43.0	56.0
	F9 right opening head	13	2	0.0	13.0	
F10 + F11 right jamb	F10 right fixed jamb	43	n/a	n/a	43.0	56.0
	F11 right opening jamb	13	2	0.0	13.0	
F12 + F13 right threshold	F12 right fixed threshold	43	n/a	n/a	43.0	56.0
	F13 right opening threshold	13	2	0.0	13.0	
Total gasket area				0		m²

Frame conductance:

All L values to **4DP**. All b values to **ODP**

	$L_{i,2D}$	$W/(m \cdot K)$	b_g (mm)	$L_{\psi,2D}$	$W/(m \cdot K)$	b_g (mm)
F3 + F4 left jamb	0.6302	190	0.6182	190		
F5 + F6 left threshold	0.6302	190	0.6182	190		
F7 Meeting Stile	0.9226	380	0.8963	380		
F8 + F9 right head rail	0.6302	190	0.6182	190		
F10 + F11 right jamb	0.6302	190	0.6182	190		
F12 + F13 right threshold	0.6302	190	0.6182	190		

Frame:

Section	b_i (no gaskets)	U_i	Frame areas (no gaskets)	Heat flow, HU	ψ	l_g	Heat flow, H ψ
	(m)	(W/(m²·K))	(m²)	(W/K)	(W/(m·K))	(m)	(W/K)
F1 + F2 left head rail	0.0560	6.2953	0.0543	0.3415	0.0529	0.9205	0.0487
F3 + F4 left jamb	0.0560	6.2953	0.1189	0.7488	0.0529	2.0720	0.1095
F5 + F6 left threshold	0.0560	6.2953	0.0543	0.3415	0.0529	0.9205	0.0487
F7 Meeting Stile	0.0550	6.6778	0.1145	0.7643	0.1034	2.0720	0.2143
F8 + F9 right head rail	0.0560	6.2953	0.0543	0.3415	0.0529	0.9205	0.0487
F10 + F11 right jamb	0.0560	6.2953	0.1189	0.7488	0.0529	2.0720	0.1095
F12 + F13 right threshold	0.0560	6.2953	0.0543	0.3415	0.0529	0.9205	0.0487
Totals		0.5694	3.6281			Total	0.6280

Air Leakage loss:

Air leakage at 50 Pa per hour & per unit length of opening light (BS 6375-1) - **2DP**

Opening light length	10.1100	m	Total air leakage	15.468	m³/h
L_{50}	3.55	m³/(m²·h)	Heat loss = 0.0165 L_{50}	0.06	W/(m²·K)

Other parameters needed for calculation, taken from simulations:

$\lambda_p = 0.035$ W/(m·K) $R_{se} = 0.04$ m²·K/W $d_p = d_g = 0.018$ m
 $R_p = 0.5143$ m²·K/W $R_{tot} = 0.6843$ m²·K/W $R_{so} = 0.13$ m²·K/W
 $U_p = 1.4614$ W/(m²·K)

U_d

No bars; or attached bars	1.95	W/(m²·K)
Single cross bar in IGU	2.0	
Multiple cross bar in IGU	2.1	
Glazing bar (Georgian bar)	2.3	

BFRC Rating =

$218.6g_d - 68.5 \times (U_d + \text{Effective } L_{50}) =$ **-8.71**

Climate zone is: **UK**

BFRC Rating kWh/(m²·yr)	Label index	EDER Rating Scale	Door Rating
≥ 10	-9	A+	B
0 to 10		A	
-10 to <0		B	
-20 to <-10		C	
-30 to <-20		D	
-50 to <-30		E	
<-50	F		

Thermal transmittance, W/(m²·K)	U_{door}	1.9
Solar factor	g_{door}	0.59
Door air leakage heat loss, W/(m²·K)	L_{factor}	0.06



Simulator Name: **Richard Bate** BFRC Certified Simulator **001**

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BS EN 673 Spreadsheet

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

Number of spaces	Help	
1		
Spaces 1		
Glazing orientation	Vertical	
Resistivity panes	1	m·K/W
Outside		
Calculate	Gas	
	Krypton	
Thickness (mm)	4.0	10
Normal emissivity	0.89	0.05
$\sum d_i r_i =$	0.008	
	Uncoated	

For uncoated surfaces input 0.89 for normal emissivity, which corresponds to a corrected emissivity of 0.8:

External, R_{se}	0.04	(m ² ·K)/W
Internal, R_{si}	0.13	(m ² ·K)/W
Iteration number	U value	$\sum 1/h_s$
	W/(m ² ·K)	(m ² ·K)/W
1	1.120	0.71474
2	1.120	0.71474

λ_{eff}	ΔT
W/(mK)	
0.0140	15
0.0140	15

Thermal Conductance Values Used

Material/Conductance W/(m.K)	Reference
Steel / 50.0	(Annex A BS EN ISO 10077-2)
EPDM / 0.25	(Annex A BS EN ISO 10077-2)
Silicone / 0.35	(Annex A BS EN ISO 10077-2)
Polyethylene Foam / 0.05	(Annex A BS EN ISO 10077-2)
Soda Lime Glass / 1.0	(Annex A BS EN ISO 10077-2)
Polysulfide/Polyurethane / 0.40	(Annex A BS EN ISO 10077-2)
Swisspacer Ultimate / 0.15	(BF Datasheet No W19 – Revision index 1-05/2016)

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Spacer Conductivity

April 2013 – No. W19 – Revision Index 1-05/2016

'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

	Product name	Space height in mm	Material	Thickness d in mm
Cross-section		6,5	Plastic/ Multilayer – polyester coated film "High Tech Gas Barrier Foil"	1.0 0.097

	Representative glass constructions	Metal with thermal break	Plastic	Wood	Wood/Metal
Representative frame profile					
Representative psi value double sheet thermally insulating glass W/m ² K	<p>Double sheet insulating glass $U_g = 1.1 \text{ W/m}^2\text{K}$</p>	0.036	0.032	0.031	0.032
Representative psi value triple sheet thermally insulating glass W/m ² K	<p>Triple sheet insulating glass $U_g = 0.7 \text{ W/m}^2\text{K}$</p>	0.031	0.030	0.029	0.030

Two Box model Characteristic value	Space between panes in mm	$\lambda_{eq,2B}$ in W/mK	
		Box 1 - $h_1 = 3 \text{ mm}$	Box 2 - $h_2 = 6.5 \text{ mm}$
	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 $\pm 0.003 \text{ W/mK}$. 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:

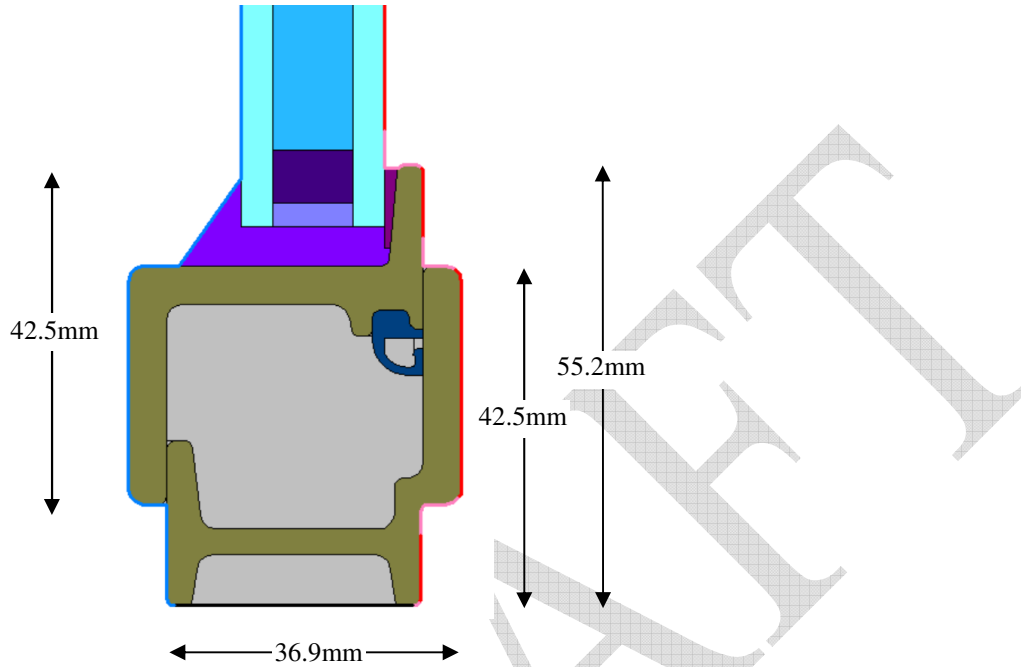
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Appendix

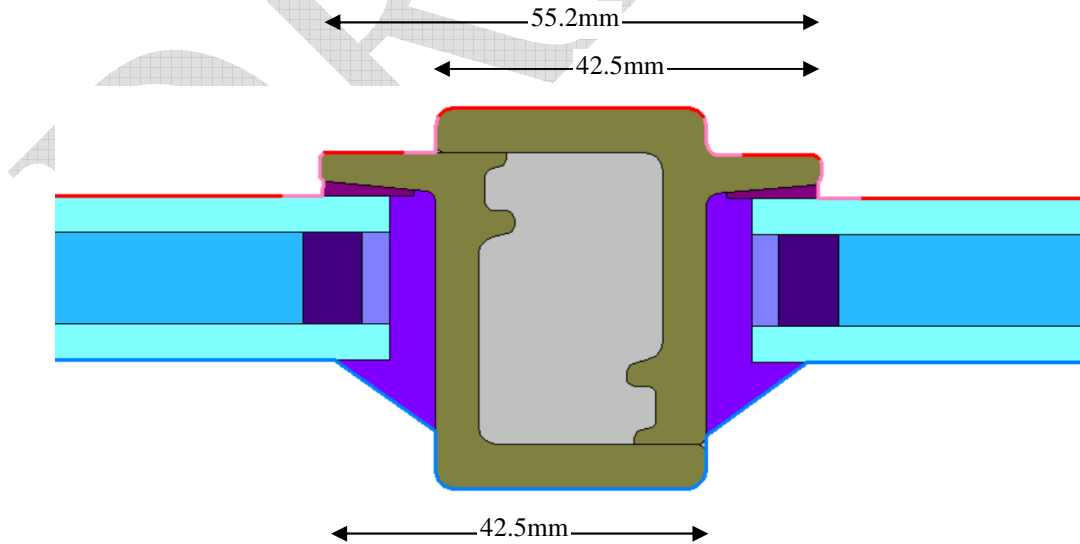
Profile Drawings

(See Technical Specification for dimensions)

Outer Frame



Meeting Stile



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