



WER Report In Accordance substantially with BS.EN.ISO.10077-2: 2003
and BFRC Guidelines and Regulations for:

ALUPLAST IDEAL 70 SYSTEM

Reference window setup of:

Outer Frame	Intermediate - OF60
Outward Opening Sash	Casement – SA75
Mullion	Intermediate – ZM70
Glazing Bead	36mm – GB36
Reinforcement	FULL
IGU setup	40W-12Ar-4K(S)-12Ar-4K(S)

With a resulting WER Rating of A+ (+11)

BALLOO TRADE FRAMES LIMITED
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1. Introduction

All figures and values stated in this report were obtained using LBNL Therm 5.2. The program has been validated against proofs D1-D10 in Annex D of BS EN ISO 10077-2:2003.

2. Formal Simulation Basis

All simulations and values in the report are based on the following documents:

- BS EN ISO 1077-2:2003 – Thermal transmittance for frames
- BS EN 12524:2000 – Thermal transmittance for materials. Generic data for all materials used in accordance with the above standards, unless stated otherwise. The source for non-standard data is stated.
- GGF BFRC Approved Simulator Guidelines
- BS EN 673 – Centre U-Pane Value for Glazing
- EN 410 – Solar Gain Transmittance
- BS 6375-1 – Air Permeability

3. Disclaimer

Please note all results in this report are provisional, until confirmed by BFRC during later parts of the WER certification process. The Simulator and Aluplast undertake to carry out the simulation to their best knowledge and capabilities. The Simulator and Aluplast disclaims any warranty or merchantability of fitness for a particular purpose. The Simulator and Aluplast will not be responsible for any damages your business may suffer.

4. Summary of Results

Results are summarized in sections dedicated to particular components of a reference window. Relevant BS\EN norm is given for every component.

a. Frame Thermal Transmittance (BS EN ISO 10077-2)

Section	Frame Thermal Transmittance (U_f)
Figure 1 – Fixed with steel	1,2 W(m ² *K)
Figure 2 – Sash with steel	1,3 W(m ² *K)
Figure 3 – Sash with rotated steel	1,3 W(m ² *K)
Figure 4 – Mullion with steel	1,3 W(m ² *K)

b. Linear Thermal Transmittance

Section	Linear Thermal Transmittance (Ψ)
Figure 1 – Fixed with steel	0,04 W(m ² *K)
Figure 2 – Sash with steel	0,04 W(m ² *K)
Figure 3 – Sash with rotated steel	0,04 W(m ² *K)
Figure 4 – Mullion with steel	0,04 W(m ² *K)

c. Centre Pane U-Value of the Glazing

Insulated Glazing Unit	Centre Pane U-Value (U_g)
4-12-4-12-4 Outer pane 4 mm Pilkington Optiwhite 12mm 90% Argon, Swiss V (St Gobain) spacer bar, secondary sealant PU (polyurethane) middle and Inner Pane 4mm Pilkington K (S), emissivity 0,05	0,763 W(m ² *K)

d. Thermal Performance of the Window (BFRC Guidelines and Regulations)

Window composition	Window
Ideal 70 Intermediate outerframe (OF60), Casement Sash (SA75), Intermediate Mullion (ZM70) 4-12-4-12-4 Outer pane 4 mm (Pilkington) Optiwhite; 12mm 90% Argon, Swiss V (St Gobain) spacer bar, secondary sealant PU (polyurethane); middle and inner Pane 4mm (Pilkington) K (S), emissivity 0,05	1,08 W(m ² *K)

e. The Effective L₅₀ (Thermal effect of air leakage – BS6375-1 and BFRC Guidelines and Regulations)

Total Air Leakage @ 50 Pa	Effective L ₅₀
0,14 m ³ (m*h)	0,00 W(m ² *K)

f. Solar Energy Transmittance – Solar Gain (g) (EN410)

IGU Composition	g window
4-12-4-12-4 Outer pane 4 mm (Pilkington) Optiwhite; 12mm 90% Argon, Middle and inner Pane 4mm (Pilkington) K (S)	0,64 (64%)



5. BFRC WER Rating (BFRC Guidelines and Regulations)

Window composition	Rating (value)	Rating (scale)
Ideal 70 Intermediate outerframe (OF60), Casement Sash (SA75), Intermediate Mullion (ZM70) 4-12-4-12-4 Outer pane 4 mm (Pilkington) Optiwhite; 12mm 90% Argon, Swiss V (St Gobain) spacer bar, secondary sealant PU (polyurethane); middle and inner Pane 4mm (Pilkington) K (S), emissivity 0,05	<h1>+11</h1>	<h1>A+</h1>

6. Appendixes

a. Appendix 1 – Technical Specification

Section	Section code	Material type	Dimensions
Outerframe – intermediate	OF60 – 10xx03	Aluplast PVC	60mm x 70mm
Casement Sash	SA75 – 10xx05	Aluplast PVC	75,5mm x 70mm
Mullion	ZM70 – 10xx12	Aluplast PVC	70mm x 70mm
Glazing Bead 36 mm	GB36 – 1208x9	Aluplast PVC	20mm x26mm

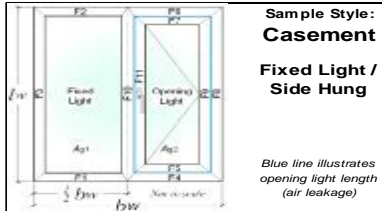
Reinforcement	Reinforcement code	Material type	Dimensions
Outerframe	209001	Aluplast steel	32mm x 3,5mm
Casement Sash	209005C	Aluplast steel	26mm x 12 mm
Mullion	209002	Aluplast steel	32mm x 15 mm
Glazing Bead 24mm	N/A	Aluplast steel	N/A

Gaskets and Seals on section:	Material type
Outerframe	Aluplast PVC-P coextruded to section
Casement Sash	Aluplast PVC-P coextruded to section
Mullion	Aluplast PVC-P coextruded to section
Glazing Bead 28mm	Aluplast PVC-P coextruded to section

IGU Composition	Specification	Value
Outer Pane	Thickness	4 mm
	Manufacturer	Pilkington
	Type	Optiwhite
Spacerbar	Manufacturer	St Gobain
	Type	Swisspacer V
Cavity	Distance	12mm
	Filling	Argon 90%, Air 10%
Sealant	Manufacturer	Generic
	Type	Polyurethane
Middle and inner pane	Thickness	4mm
	Manufacturer	Pilkington
	Type	K (S) (0,05)
Overall Unit	Thickness	36mm

Conductivity	Material	Lambda value	Source
Frames	uPVC	0,145	Test to EN ISO 8302:1999
Beads	uPVC	0,145	Test to EN ISO 8302:1999
Gaskets	pPVC	0,140	EN12524
Reinforcement	Stainless steel	50,000	EN12524
Glass	Soda lime sil.	1,000	EN12524
Spacer	Swiss U	0,180	St Gobain
Secondary sealant	PU	0,400	EN12524

b. Appendix 2 – BFRC Spreadsheet



Sample Style:
Casement
Fixed Light / Side Hung

Blue line illustrates opening light length (air leakage)

Report Number: **176 balloo 36mm** Issue No 22.1: 11/03/2013
Report Date: **16-01-2014**
Project Details:

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

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

Frame offset:	No
Nominal 4mm etc to ODP, 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 0,763 W/(m²·K)
g-value - 2DP	g 0,64

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

Section	Window Dimensions:		Area	
	Length (m)	Width (m)	No gasket (m²)	With gasket (m²)
Fixed Light	1,3600	0,5335	0,7256	0,7180
Opening light	1,2640	0,4105	0,5189	0,5122
Total glazing, A_w		1,2444	1,2302	
Frame	(m)	(m)	(m²)	(m²)
F1	0,6150	0,0600	0,0345	0,0355
F2	0,6150	0,0600	0,0345	0,0355
F3	1,4800	0,0600	0,0852	0,0879
F4	0,6150	0,0330	0,0194	0,0194
F5	0,5605	0,0750	0,0364	0,0372
F6	0,6150	0,0330	0,0194	0,0194
F7	0,5605	0,0750	0,0364	0,0372
F8	1,4800	0,0330	0,0478	0,0478
F9	1,4140	0,0750	0,1004	0,1029
F10	1,4800	0,0430	0,0616	0,0644
F11	1,4140	0,0750	0,1004	0,1029
Total Frame		0,5760	0,5902	
Total Window, A_w		1,8204	1,8204	
Percentage fixed light glass area		39,86%	39,44%	
Percentage opening light glass area		28,50%	28,14%	
Percentage glass area (total)		68,36%	67,58%	

Solar Factor, g-value:	F_w 0,9
	g_w 0,39

U_{window}	No bars; or attached bars	1,08	W/(m²·K)
	Single cross bar in IGU	1,2	
	Multiple cross bar in IGU	1,3	
	Glazing bar (Georgian bar)	1,5	

BFRC Rating kWh/(m²·yr)	Label index	EWER Rating Scale	Window Rating
≥10	Z	A+	A+
0 to <10		A	
-10 to <0		B	
-20 to <-10		C	
-30 to <-20		D	
-50 to <-30		E	
-70 to <-50		F	

Frame dimensions:	(b _j)	Frame width, b _j	Gasket protrusion, b _g	Frame & gasket widths	
		(mm)	(mm)	(mm)	
All frame values round to nearest 1mm, gaskets to 1DP	F1 fixed sill	60	2,0	62,0	Total
	F2 fixed head	60	2,0	62,0	
	F3 fixed jamb	60	2,0	62,0	
F4 + F5 sash sill	F4 fixed sash sill	33	n/a	33,0	110,0
	F5 moving sash sill	75	2,0	77,0	
F6 + F7 sash head	F6 fixed sash head	33	n/a	33,0	110,0
	F7 moving sash head	75	2,0	77,0	
F8 + F9 sash jamb	F8 Fixed sash jamb	33	n/a	33,0	110,0
	F9 moving sash jamb	75	2,0	77,0	
F10 + F11 mullion	F10 fixed mullion	43	2,0	45,0	122,0
	F11 moving mullion	75	2,0	77,0	
Total gasket area				0,01424	m²

Frame conductance:	All L values to 4DP. All b values to ODP			
	$L_{F,2DP}$	W/(m²·K)	b _j (mm)	$L_{\psi,2DP}$
F1 fixed sill	0,2308	190	0,2570	190
F2 fixed head	0,2308	190	0,2570	190
F3 fixed jamb	0,2308	190	0,2570	190
F4 + F5 sash sill	0,3026	190	0,3283	190
F6 + F7 sash head	0,3026	190	0,3283	190
F8 + F9 sash jamb	0,2990	190	0,3250	190
F10 + F11 mullion	0,4697	380	0,5226	380

Frame:	Frame width, b _j	Frame U-value, U _f	Frame areas, A _f	Frame heat flow, H _f	Linear trans., H _l	Junction heat flow, H _ψ
Section	(m)	(W/(m²·K))	(m²)	(W/K)	(W/(m·K))	(W/K)
F1 fixed sill	0,0600	1,2046	0,0345	0,0415	0,0398	0,5335
F2 fixed head	0,0600	1,2046	0,0345	0,0415	0,0398	0,5335
F3 fixed jamb	0,0600	1,2046	0,0852	0,1026	0,0398	1,3600
F4 + F5 sash sill	0,1080	1,3341	0,0558	0,0745	0,0393	0,4105
F6 + F7 sash head	0,1080	1,3341	0,0558	0,0745	0,0393	0,4105
F8 + F9 sash jamb	0,1080	1,3007	0,1482	0,1927	0,0396	1,2640
F10 + F11 mullion	0,1180	1,2937	0,1621	0,2097	0,0800	1,3120
Totals		0,5760	0,7369			0,2837

Air Leakage loss:	
Air leakage at 50 Pa per hour & per unit length of opening light (BS 6375-1) - 2DP	0,14 m³/(m·h)
Opening light length	3,9490 m
Total air leakage	0,553 m³/h
L_{50}	0,30 m³/(m²·h)
Heat loss = 0.0165 L_{50}	0,01 W/(m²·K)

Other parameters needed for calculation, taken from simulations:			
$d_p = d_g$	0,036	m	
I_p	0,035	W/(m·K)	R_{se} = 0,04 K/W
R_{a1}	1,0286	m²·K/W	R_{se} = 1,1966 K/W
			U_{a1} = 0,8343 W/(m²·K)

BFRC Rating =	218,69 U_{window} - 68,5 x (U_{window} + Effective L_{50}) =	10,59
Climat zone is:		UK
Thermal transmittance, W/(m²·K)	U_{window}	1,1
Solar factor	g_{window}	0,39
Window air leakage heat loss, W/(m²·K)	L_{factor}	0,01

Simulator Name: **Jakub Romanowski** BFRC Certified Simulator **S-090**

c. Appendix 3 – BS EN 673 Spreadsheet

Version 10 22/07/2011. Calculations according to BS EN 673:2011

Number of spaces		Help		Spaces		1		2	
2									
Glazing orientation		Vertical		Outside		90%		90%	
Resistivity panes		1		m·K/W		90%		90%	
				Emissivities		Gas		Gas	
				Calculate		Argon		Argon	
Thickness (mm)		4,0		4,0		12		12	
Normal emissivity		0,89		0,05		0,89		0,05	
$\sum d_j \cdot r_j =$		0,012		Uncoated		Uncoated			

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

Iteration number	U value	$\sum 1/h_s$	λ_{eff}	ΔT	λ_{eff}	ΔT
	W/(m ² ·K)	(m ² ·K)/W	W/(mK)		W/(mK)	
1	0,763	1,12941	0,0213	7,5	0,0213	7,5
2	0,763	1,12941	0,0213	7,5	0,0213	7,5

d. External data sheets

October 2008 – No.6 – Revision Index 2

WARM EDGE WORKING PARTY

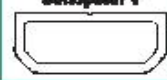

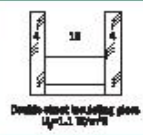
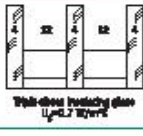
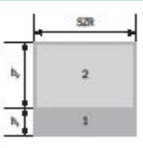
BF

Data sheet
Psi values for windows



SWISSPACER
SAINT-GOBAIN

SWISSPACER®
Verzweigt Saint-Gobain (International) AG
Zürcherstrasse 16, CH-8230 Kesswil

RAL
Zertifiziert
ISO 9001:2008
ISO 14001:2004

Product name	Spacer height in mm	Material	Thermal conductivity λ in W/mK	Thickness of the seal	
Swisspacer V 	8,5	Stainless steel Profile	15 0,38	0,01 1,0	
Representative frame profile 	Material with thermal break	Profile	Wood	Wood / Metal	
		0.039	0.034	0.032	0.035
	Double-pane insulating glass $U_{g,1.1}$ W/m²K				
		0.034	0.032	0.031	0.033
Triple-pane insulating glass $U_{g,1.2}$ W/m²K					
Two-lane window 	Spacer between panes in mm		$\lambda_{eq,sp}$ in W/mK		
			Ins 1 • h_1 = 3 mm	Ins 2 • h_2 = 6,5 mm	
	16		0.40	0.18	
12		0.40	0.18		

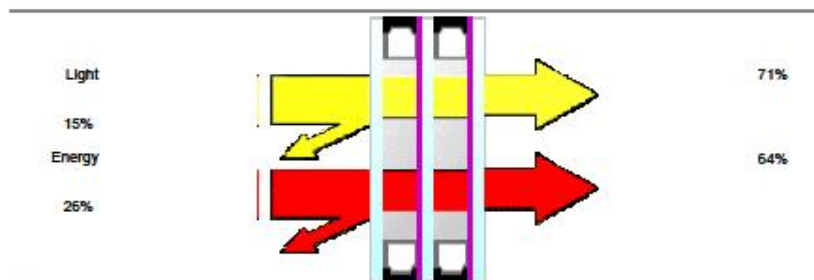
Dependencies
The representative linear heat transfer coefficient (representative psi value) is typical frame profile and glazing for the determination of the heat transfer coefficient $U_{f,w}$ of windows. The linear heat transfer coefficient for boundary conditions (frame profile, glazing, glass resulting depth, heat convection, primary and secondary outside defined in the EN standards EN-12567).
*Thermally improved spacers - Part 1: Determination of the representative psi value for relative frame profiles. This document also gives the use of validity and application of the representative psi values. In order to avoid resulting errors, the psi values in the table sheet have been given in UAW/W/m²K. The values are used for the ultimate determination of the psi value for the opening of a window. Information of the item UAW/W/m²K can be found in the EN-12567.

Credibility value determined by:



e. Appendix 4 – IGU chart

Spectrum On-line

Strona 1 z 1



Description

Position	Product	Process	Thickness (nominal) mm	Weight kg/m ²
Glass 1	Pilkington Optiwhite	Annealed	4	10
Cavity 1	Argon (90%)		12	
Glass 2	Pilkington K Glass S	Annealed	4	10
Cavity 2	Argon (90%)		12	
Glass 3	Pilkington K Glass S	Annealed	4	10
Product Code	4w-12Ar-KS4-12Ar-KS4		36	30

Performance

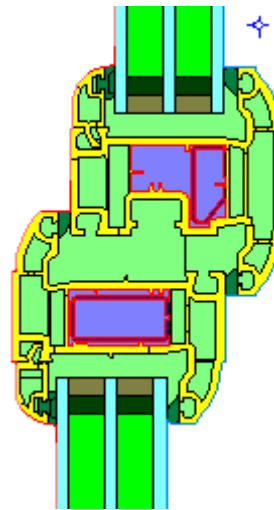
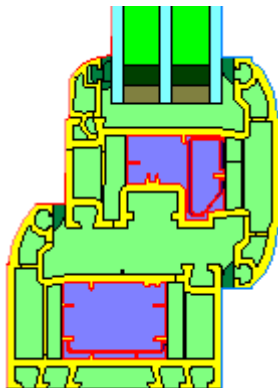
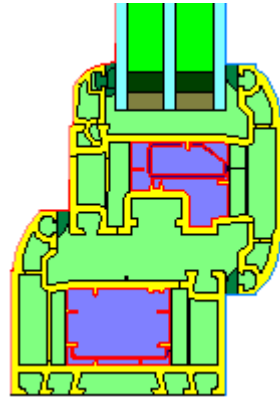
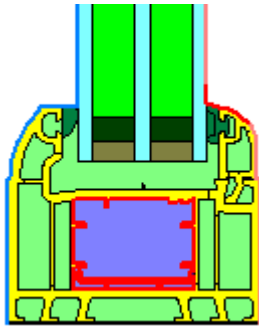
Light			Sound Reduction	R_w dB (C;C _{tr})	32 (-1; -5)
Transmittance	LT	71%	Thermal Transmittance	W/m^2K	0.76
	UV %	27%			
Reflectance Out	LR out	15%	Ra		98
Reflectance In	LR in	16%	Performance Code		
Energy			U-value/Light/Energy 0.76 / 71 / 64		
Direct Transmittance	ET	50%	The values of some of characteristics are displayed as NPD. This stands for No Performance Determined.		
Reflectance	ER	26%			
Absorptance	EA	24%			
Total Transmittance	g	64%			
Shading Coefficient Total		0.73			
Shading Coefficient Shortwave		0.57			

Pilkington Spectrum allows you to combine a wide range of products available from Pilkington and determine their key properties such as light transmittance, g value and U value. The program includes restrictions that prevent some combinations being selected that may be considered unwise or impractical. Even with these restrictions, it is still possible to create product combinations that may not be available from your supplier. Please check with your supplier that your chosen product combination is possible, available in the sizes required and in a timescale appropriate to your project. Furthermore, it is essential that you check that your product combination is appropriate for satisfying local, regional, national and other project-specific requirements.

Calculations are made according to EN standards 410 and 673/12898
Pilkington Spectrum Version 4.0.0

27/06/2014

f. Therm 5.2 Profile Images





7. Report Authorization

Report reference: 176

On request of : Balloo Trade Frames

Prepared on : 27-06-2014

Prepared by: Jakub Romanowski, Certified Simulator S-090

Signature: _____