

Report in Accordance with BFRC Guidelines and Regulations

Product description: “The Sash Window Workshop Accoya Casement Window”

CONFIDENTIAL

Client:	The Sash Window Workshop Ltd Unit 4 Kiln Lane Bracknell Berkshire RG12 1NA
Project:	Accoya Casement Window
Project reference:	CU14332-3
Prepared By:	Richard Bate Technical Director
Issue date:	27 April 2015

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Approved Simulator 001

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1 Introduction

The U-value calculations of The Sash Window Workshop Accoya casement window detailed below were commissioned by Peter Smith of The Sash Window Workshop.

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 BFRC 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)

SWW Accoya Casement Frame Profile	Frame Thermal Transmittance (U_f)
Fixed Head & Jamb	1.5 W/(m ² ·K)
Fixed Cill	1.3 W/(m ² ·K)
Mullion	1.7 W/(m ² ·K)
Casement Head & Jamb	1.6 W/(m ² ·K)
Casement Cill	1.5 W/(m ² ·K)

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

SWW Accoya Casement Frame Profile	Linear Thermal Transmittance (ψ)
Fixed Head & Jamb	0.034 W/(m·K)
Fixed Cill	0.034 W/(m·K)
Mullion	0.070 W/(m·K)
Casement Head & Jamb	0.036 W/(m·K)
Casement Cill	0.036 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 (St Gobain Planitherm Total+), 90% argon 10% air filled, low iron outer pane (St Gobain Diamant) glazing unit with Edgetech Superspacer Premium spacer bar with 5mm hot melt butyl secondary seal.	1.5 W/(m ² ·K)

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

SWW Accoya Casement Frame Profile	Window U-Value
Timber frame system with 4-10-4 Low-E 0.05 uncorrected emissivity (St Gobain Planitherm Total+), 90% argon 10% air filled, low iron outer pane (St Gobain Diamant) glazing unit with Edgetech Superspacer Premium spacer bar with 5mm hot melt butyl secondary seal.	1.7 W/(m ² ·K)

4.5 The Effective L₅₀ in accordance with BFRC guidelines and regulations:

SWW Accoya Casement Frame Profile	Effective L ₅₀
Air permeability at 50 pa	0.00 W/(m ² ·K)

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

SWW Accoya Casement Frame Profile	g _{window}
Timber frame system with 4-10-4 Low-E 0.05 uncorrected emissivity (St Gobain Planitherm Total+), 90% argon 10% air filled, low iron outer pane (St Gobain Diamant) glazing unit with Edgetech Superspacer Premium spacer bar with 5mm hot melt butyl secondary seal.	0.47


5.0 BFRC Rating

5.1 SWW Accoya Casement window system

SWW Accoya Casement Frame Profile	Rating
Timber frame system with 4-10-4 Low-E 0.05 uncorrected emissivity (St Gobain Planitherm Total+), 90% argon 10% air filled, low iron outer pane (St Gobain Diamant) glazing unit with Edgetech Superspacer Premium spacer bar with 5mm hot melt butyl secondary seal.	-15 (Rating Scale C)

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6.0 Authorisation

	Prepared by:
Signature:	
Name:	Richard Bate
Title:	Technical Director

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Technical Specification

Profiles		Ref. No.	Material Type/Manufacturer's Name & Density (Timber only)	Dimensions (Height & Width)
Outer Frame	Head & jambs	N/A	Accoya - Sash Window Workshop	45mm x 90mm
	Cill	N/A	Accoya – Sash Window Workshop	55mm x 145mm
Sash	Top rail & jambs	N/A	Accoya – Sash Window Workshop	52mm x 48mm
	Bottom rail	N/A	Accoya – Sash Window Workshop	90mm x 48mm
Mullion		N/A	Accoya – Sash Window Workshop	40mm x 90mm
Fixed Glass Check Bead		N/A	Accoya – Sash Window Workshop	15mm x 55mm
Casement Check Bead		N/A	Accoya – Sash Window Workshop	15mm x 33mm
Glazing Bead		N/A	Accoya – Sash Window Workshop	15mm x 6mm
Cill Fixed Glass Shim		N/A	Accoya – Sash Window Workshop	8.1mm x 51.3mm

Weather Seals	Ref. No.	Material Type/ Manufacturer's Name
Glazing Bead	N/A	Silicone sealant
Glazing Rebate	N/A	Silicone sealant
Casement Rebate	R12	Polypropylene - Reddiseal

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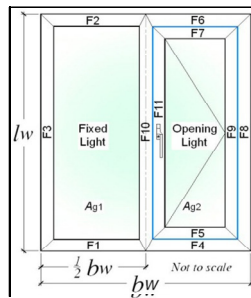
Glazing Component	Specification
Overall sealed unit: 1. Thickness (mm)	1. 18mm
Outer pane 1. Thickness (mm) 2. Manufacturer 3. Description	1. 4mm 2. St Gobain 3. Diamant
Inner pane: 1. Thickness 2. Manufacturer 3. Description	1. 4mm 2. St Gobain 3. Planitherm Total+
Spacer bar: 1. Manufacturer 2. Description	1. Edgetech 2. Superspacer Premium
Cavity 1. Distance (mm) 2. Gas %	1. 10mm 2. Argon 90% Air 10%
Edge seal 1. Manufacturer 2. Description	1. N/A 2. 5.3mm Hot Melt Butyl

Additional Notes

Air leakage data is taken from Build Check Ltd Test report ref. W10168-2 dated 28 May 2010 (data at 50Pa pressure = 0.00 m³/h/m).

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 0.74.

BFRC Spreadsheet



Sample Style:
Casement

Fixed Light /
Side Hung

Blue line illustrates
opening light length
(air leakage)

Report Number: **U14332-3** Issue No 22.1: 11/03/2013
 Report Date: **23 March 2015**
 Project Details: **Accoya Casement, Superspacer Premium, Total+, Diamant**

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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 ODP	l_w	1480 mm
Total window width ODP	b_w	1230 mm

Frame offset: **No**

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)	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. - 3DP	U_g	1.510 W/(m ² ·K)
g-value - 2DP	g_w	0.74

Thermal transmittance of window from hot box test

$U_w - 2DP$ **0.74** W/(m²·K)

Window Dimensions:

Section	Length		Area	
	(m)	(m)	No gasket (m ²)	With gasket (m ²)
Fixed Light	1.3500	0.5200	0.7020	0.6953
Opening light	1.2400	0.4400	0.5456	0.5396
Total glazing, A_g		1.2476	1.2348	
Frame				
F1	0.6150	0.0700	0.0397	0.0407
F2	0.6150	0.0600	0.0341	0.0350
F3	1.4800	0.0600	0.0849	0.0873
F4	0.6150	0.0700	0.0341	0.0341
F5	0.5200	0.0700	0.0336	0.0344
F6	0.6150	0.0600	0.0397	0.0397
F7	0.5200	0.0400	0.0192	0.0200
F8	1.4800	0.0600	0.0849	0.0849
F9	1.3500	0.0400	0.0518	0.0540
F10	1.4800	0.0700	0.0991	0.1015
F11	1.3500	0.0400	0.0518	0.0540
Total Frame		0.5728	0.5856	
Total Window, A_w		1.8204	1.8204	
Percentage fixed light glass area		38.56%	38.19%	
Percentage opening light glass area		29.97%	29.64%	
Percentage glass area (total)		68.53%	67.83%	

Solar Factor, g-value:

F_w	0.9
g_w	0.45

U_{window}

No bars; or attached bars	1.66	W/(m ² ·K)
Single cross bar in IGU	1.8	
Multiple cross bar in IGU	1.9	
Glazing bar (Georgian bar)	2.1	

BFRC Rating kWh/(m ² ·yr)	Label index	EWER Rating Scale	Window Rating
≥10	-15	A+	C
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:

All frame values round to nearest 1mm, gaskets to 1DP	Frame width, b_f (mm)	Gasket protrusion, b_{g1} (mm)	Frame & gasket widths (mm)	Total
F1 fixed sill	70	1.8	71.8	
F2 fixed head	60	1.8	61.8	
F3 fixed jamb	60	1.8	61.8	
F4 + F5 sash sill	70	n/a	70.0	141.8
F5 moving sash sill	70	1.8	71.8	
F6 + F7 sash head	60	n/a	60.0	101.8
F7 moving sash head	40	1.8	41.8	
F8 + F9 sash jamb	60	n/a	60.0	101.8
F9 moving sash jamb	40	1.8	41.8	
F10 + F11 mullion	70	1.8	71.8	113.6
F11 moving mullion	40	1.8	41.8	
Total gasket area			0.0127541	m ²

Where a U_w value from hot box testing is available, no L_f^{2D} or L_w^{2D} values need to be entered

Frame conductance:

Section	All L values to 4DP . All b values to ODP		L_f^{2D}	L_w^{2D}
	W/(m·K)	b_g (mm)		
F1 fixed sill	0.3704	190		0.4132
F2 fixed head	0.3673	190		0.4100
F3 fixed jamb	0.3673	190		0.4100
F4 + F5 sash sill	0.4868	190		0.5322
F6 + F7 sash head	0.4338	190		0.4789
F8 + F9 sash jamb	0.4338	190		0.4789
F10 + F11 mullion	0.7457	380		0.8337

Frame:

Section	Frame width, b_f (m)	Frame U-value, U_f (W/(m ² ·K))	Frame area, A_f (m ²)	Frame heat flow, HU (W/K)	Linear trans. (W/(m·K))	Linear length, l_g (m)	Junction heat flow, H_ψ (W/K)
F1 fixed sill	0.0700	1.3248	0.0397	0.0526	0.0336	0.5200	0.0175
F2 fixed head	0.0600	1.4940	0.0341	0.0509	0.0335	0.5200	0.0174
F3 fixed jamb	0.0600	1.4940	0.0849	0.1268	0.0335	1.3500	0.0452
F4 + F5 sash sill	0.1400	1.4938	0.0677	0.1011	0.0362	0.4400	0.0159
F6 + F7 sash head	0.1000	1.5614	0.0589	0.0920	0.0359	0.4400	0.0158
F8 + F9 sash jamb	0.1000	1.5614	0.1367	0.2134	0.0359	1.2400	0.0445
F10 + F11 mullion	0.1100	1.7307	0.1509	0.2611	0.0695	1.2950	0.0900
Totals		0.5728	0.8979			Total	0.2462

Air Leakage loss:

Air leakage at 50 Pa per hour & per unit length of opening light (BS 6375-1) - 2DP	0.00	m ³ /(m·h)
Opening light length	3.7400	m
Total air leakage	0.000	m ³ /h
L_{50}	0.00	m ³ /(m ² ·h)
Heat loss = 0.0165 L_{50}	0.00	W/(m ² ·K)

Other parameters needed for calculation, taken from simulations:

$d_p = d_g =$	0.018	m
$\lambda_p =$	0.035	W/(m·K)
$R_{se} =$	0.04	°K/W
$R_{sp} =$	0.13	m ² ·K/W
$R_p =$	0.5143	m ² ·K/W
$R_{tot} =$	0.6843	°K/W
$U_p =$	1.4614	W/(m ² ·K)

BFRC Rating =

218.6g_{window} - 68.5 x (U_{window} + Effective L₅₀) = -15.34

Climate zone is: UK

Thermal transmittance, W/(m ² ·K)	U_{window}	1.7
Solar factor	g_{window}	0.45
Window air leakage heat loss, W/(m ² ·K)	L_{factor}	0.00



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

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BS EN 673 Spreadsheet

Version 11 23/10/2012. Calculations according to BS EN 673:2011

Number of spaces	Help	
1		

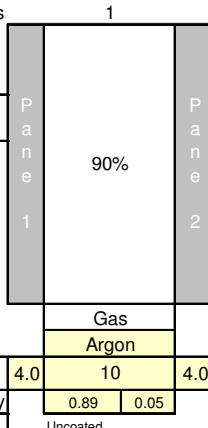
Spaces 1

Glazing orientation	Vertical	
Resistivity panes	1	m·K/W

Outside

Emissivities

Calculate



Thickness (mm)	4.0	10	4.0
Normal emissivity		0.89	0.05
$\sum d_j r_j = 0.008$	Uncoated		

For uncoated surfaces input 0.89 for normal emissivity, which corresponds to a corrected emissivity of 0.83

Iteration number	U value	$\sum 1/h_s$	λ_{eff}	ΔT
	W/(m ² ·K)	(m ² ·K)/W		
1	1.510	0.48425	0.0207	15
2	1.510	0.48425	0.0207	15

Thermal Conductivity Values Used

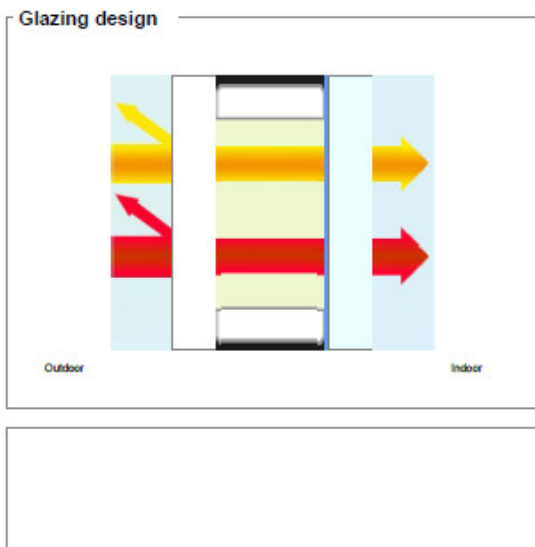
Material/Conductivity W/(m.K)	Reference
PVCu / 0.17	(Annex A BS EN ISO 10077-2)
Accoya / 0.12	(IFT Rosenheim report 10-000788-PR01)
Silicone / 0.35	(Annex A BS EN ISO 10077-2)
Soda Lime Glass / 1.0	(Annex A BS EN ISO 10077-2)
Hot Melt Butyl / 0.24	(Annex A BS EN ISO 10077-2)
Superspacer Premium / 0.15	(BF Website)
Elastomeric Foam / 0.05	(Annex A BS EN ISO 10077-2)

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G Value Source



Calumen® II 1.3.1
14 April 2015
Data base : SGG UK



	First glazing	Second glazing
Gas		Argon 90% 10.00mm
Coating		PLANITHERM TOTAL+
First glass	DIAMANT 4.00mm	PLANICLEAR 4.00mm
Coating		
Layer		
Coating		
Second glass		
Coating		

Manufacturing sizes

Nominal thickness :	18.0 mm
Weight :	20.0 kg/m ²

Luminous factors (EN410-2011) : (D65 2°)

Transmittance :	81 %
Outdoor reflectance :	12 %
Indoor reflectance :	13 %

Energy factors (EN410-2011) :

Transmittance :	66 %
Outdoor reflectance :	21 %
Indoor reflectance :	20 %
Absorptance A1 :	3 %
Absorptance A2 :	10 %

Solar factors (EN410-2011) :

g :	0.74
Shading coefficient :	0.85

Thermal transmission (EN673-2011) - 0° related to vertical position

U _g :	1.5 W/(m ² .K)
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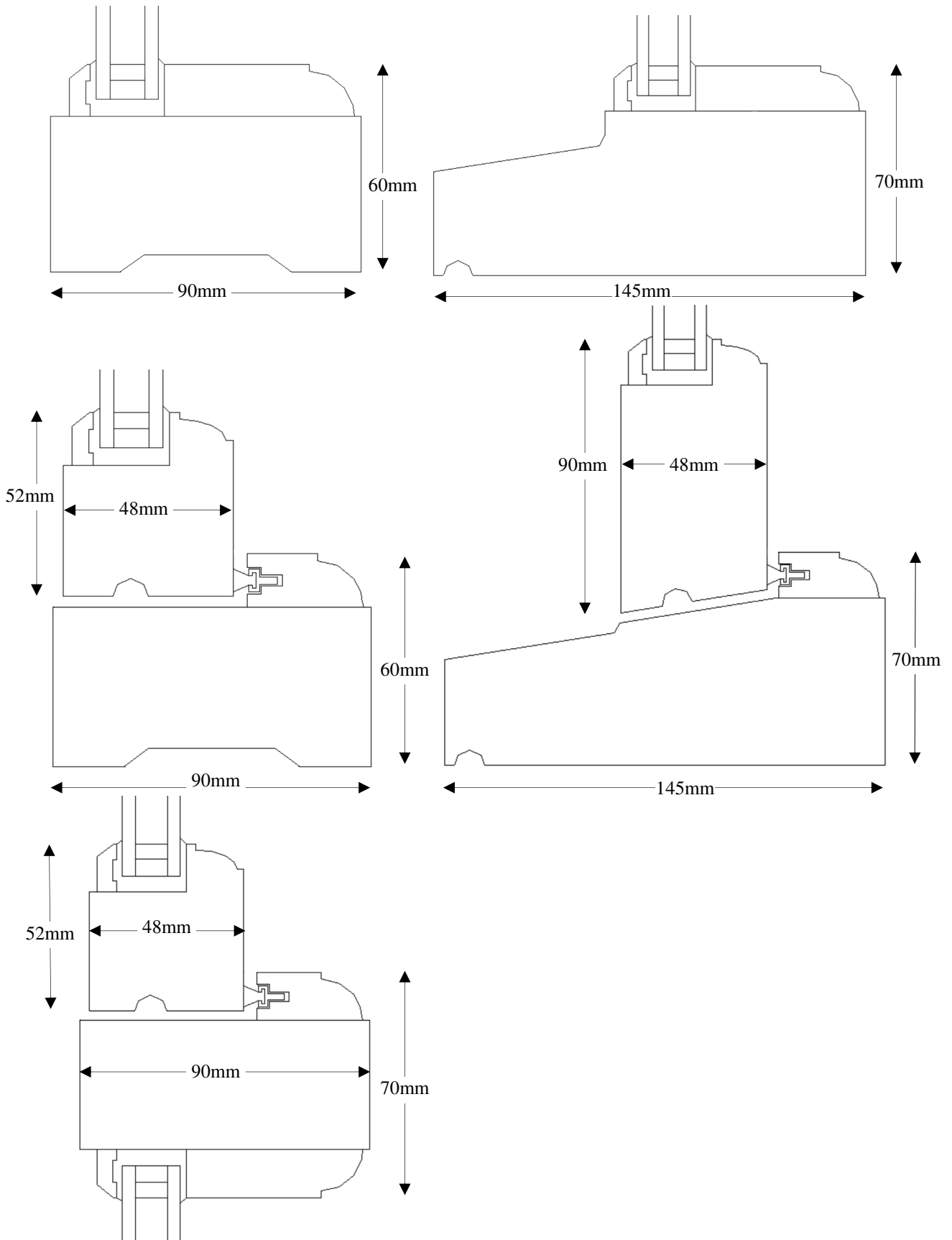
CALLUMEN® II is a simulation software to calculate key performance of glass such as light transmittance, solar factor or thermal insulation coefficient. Computed values are indicative and subject to change. They can not be used to guarantee performance of the products.

These values are calculated according to EN410-2011 and EN673-2011 standards. Tolerances are defined according to EN 1098-4 or ISO9050-2003 standards. Nevertheless, user must check the feasibility of the associated products, in particular in terms of thickness and colour. Furthermore, it is his responsibility to check that the resulting combination of glazing meets regulatory requirements at national, local or regional level.

Calculation rules and functional output of Calumen II have been validated by TÜV Rheinland Quality Report 11923R-11-33705



Appendix Profile Drawings



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