

ENERGY RATING REPORT

REPORT NUMBER: 1957 Page 1 of 10


Window System	Spectus Vertical Slider – Standard Bottom Rail
Size & Style	1230mm x 1480mm VS
Frame Material	PVC-U
Outer Frame Reference	VS01
Outer Frame Thermal Enhancement	EPS70
Top Sash Reference	VS03
Top Sash Reinforcement	VSX03 (PVC-U)
Bottom Sash Reference	VS04
Bottom Sash Reinforcement	VSX04 (PVC-U)
Cill Reference	VS02
Cill Rein./Thermal Enhancement	N/A
Glazing Bead Reference	VS06 & VS07
Glazing Bead Detail	PVC-U Bead with PVC-P Co-Ex Gasket
Gaskets	PVC-P Bubble Co-extruded to profiles
Weatherseals	Polypropylene 'Wool Pile'
Bottom Weatherseal	PVC-P Bubble
Glazing Description	24mm Double Glaze Unit
Outer Pane	4mm Planiclear
Cavity	16mm 90% Argon
Inner Pane	4mm Planitherm Total+
Spacer Bar	Thermobar
Secondary Sealant	Butyl

RESULTS

BFRC ENERGY RATING BAND	A+	
BFRC Energy Rating Index	13	kWh/(m² yr)
Thermal Transmittance (U_{window})	1.4	W/(m² K)
Solar Factor (g_{window})	0.49	
Air Leakage Heat Loss (L_{factor})	0.02	W/(m² K)

Prepared by: Steve Wright (Certified Simulator No. 044)
Chief Designer
Spectus Window Systems

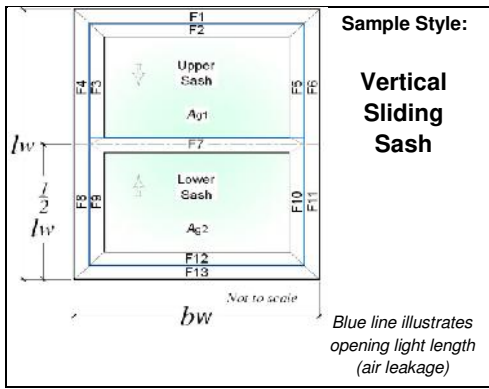
Signed:



Date: 26th March 2015



**BFRC Certified
Simulator 044**



Report Number: **1957**
 Report Date: **26th. March 2015**

Report Issue No.15.1 (11/03/13)

Project Details: **Std Btm Rail with VSX in Sashes, Foam in outers not cill - Planiclear - 90% Argon- PLT+ Thermobar + Butyl**

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Input Values:
 Yellow input, green intermediary, blue finals X' DP is no. of decimal place 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, d_{g1}	4.0	mm
Glazing fill thickness 1/2, d_{g11}	16.0	mm
Gas fill (1/2)	Argon 90%	
Thickness of pane 2, d_{g2}	4.0	mm
Complete next 3 cells for TG IGU		
Glazing fill thickness 2/2, d_{g12}		mm
Gas fill (2/3)		
Thickness of pane 3, d_{g3}		mm
Glazing Trans. - 3DP	U_g	1.195 W/(m ² K)
g -value - 2DP	g_{-}	0.73

Thermal transmittance of window from hot box test
 U_w - **2DP** **1.195** W/(m² K)

Frame dimensions (All frame values to 0dp, gaskets to 1DP)	Frame height, b_f (mm)		Gasket protrusion (mm)	With gasket (mm)	Total
	Internal	External			
F1 fixed top rail	54	70	n/a	54.0	105.0
F2 moving top rail	51	35	0.0	51.0	
F3 top (LH) jamb (moving sash)	51	35	0.0	51.0	105.0
F4 top (LH) jamb (fixed frame)	54	70	n/a	54.0	
F5 top (RH) jamb (moving sash)	51	35	0.0	51.0	105.0
F6 top (RH) jamb (fixed frame)	54	70	n/a	54.0	
F7 mid rail	63		(upper) 0.0	63.0	63.0
(lower) 0.0					
F8 bottom (LH) jamb (fixed frame)	54	70	n/a	54.0	105.0
F9 bottom (LH) jamb (moving sash)	51	35	0.0	51.0	
F10 bottom (RH) jamb (moving sash)	51	35	0.0	51.0	105.0
F11 bottom (RH) jamb (fixed frame)	54	70	n/a	54.0	
F12 bottom moving rail	40		0.0	40.0	100.0
F13 bottom fixed rail	60		n/a	60.0	
Total gasket area			0	m ²	

Window Dimensions:

Section	Length, l	Width, b	Area, A	
			No gasket	With gasket
Upper glazing	0.6035	1.0200	0.6156	0.6156
Lower glazing	0.6085	1.0200	0.6207	0.6207
Total of glazing			1.2362	1.2362
Frame	m	m	m ²	m ²
F1	1.2300	0.0540	0.0635	0.0635
F2	1.1220	0.0510	0.0546	0.0546
F3	0.6860	0.0510	0.0329	0.0329
F4	0.7400	0.0540	0.0385	0.0385
F5	0.6860	0.0510	0.0329	0.0329
F6	0.7400	0.0540	0.0385	0.0385
F7	1.1220	0.0630	0.0675	0.0675
F8	0.7400	0.0540	0.0383	0.0383
F9	0.6800	0.0510	0.0329	0.0329
F10	0.6800	0.0510	0.0329	0.0329
F11	0.7400	0.0540	0.0383	0.0383
F12	1.1220	0.0400	0.0428	0.0428
F13	1.2300	0.0600	0.0706	0.0706
Total Frame			0.5842	0.5842
Total Window, A_w			1.8204	1.8204
Percentage upper glass area			33.82%	33.82%
Percentage lower glass area			34.10%	34.10%
Percentage glass area (total)			67.91%	67.91%

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

Frame conductance:

Frame conductance	All L values to 4DP . All b values to ODP			
	$W/(m^2 K)$	b_g (mm)	L_i^{2D}	L_w^{2D}
F1+F2 top rail	0.3415	190		
F3+F4 top (LH) jamb	0.3488	190		
F5+F6 top (RH) jamb	0.3488	190		
F7 mid rail	0.5577	380	0.6382	380
F8+F9 bottom (LH) jamb	0.3582	190	0.3986	190
F10+F11 bottom (RH) jamb	0.3582	190	0.3986	190
F12+F13 bottom rail	0.3579	190	0.3980	190

Frame:

Section	Frame width, b_f	Frame U-value, U_i	Frame areas, A_i	Frame heat flow, HU	Linear trans, ψ	Linear length, l_g	Junction heat flow, H_{ψ}
	m	W/(m ² K)	m ²	W/K	W/(m K)	m	W/K
F1+F2 top rail	0.1050	1.1377	0.1181	0.1344	0.0347	1.0200	0.0354
F3+F4 top left jamb	0.1050	1.2073	0.0714	0.0862	0.0351	0.6035	0.0212
F5+F6 top right jamb	0.1050	1.2073	0.0714	0.0862	0.0351	0.6035	0.0212
F7 mid rail	0.0630	1.8036	0.0675	0.1217	0.0705	1.0200	0.0719
F8+F9 btm left jamb	0.1050	1.2968	0.0712	0.0923	0.0354	0.6085	0.0215
F10+F11 btm right jamb	0.1050	1.2968	0.0712	0.0923	0.0354	0.6085	0.0215
F12+F13 bottom rail	0.1000	1.3586	0.1134	0.1541	0.0351	1.0200	0.0358
Totals			0.5842	0.7672		Total	0.2285

Solar Factor, g -value:

glazing area A_g (m ²)	1.3592
F_w	0.9
g_w	0.49

Air Leakage loss:

Air leakage at 50 Pa per hour & per unit length of opening light (BS 6375-1) - **2DP** **0.32** m³/(m h)

Opening light length, $l_{opening}$	6.3780	m	Total air leakage	2.041	m ³ /h
L_{50}	1.12	m ³ /(m ² h)	Heat loss = 0.0165 L_{50}	0.02	W/(m ² K)

U_{window}

No bars; or attached bars	1.36	W/(m ² K)
Single cross bar in IGU	1.5	
Multiple cross bar in IGU	1.6	
Glazing bar (Georgian bar)	1.8	

Other parameters needed for calculation, taken from simulations:

$d_p = d_g =$	0.024	m
$R_p =$	0.035	W/(m K)
$R_{se} =$	0.04	m ² K/W
$R_p =$	0.6857	m ² K/W
$R_{tot} =$	0.8557	m ² K/W
$U_p =$	1.1686	W/(m ² K)

BFRC Rating kWh/(m ² yr)	Label index	EWER Rating Scale	Window Rating
≥ 10	13	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	

BFRC Rating =
 $218.6g_{window} - 68.5 \times (U_{window} + \text{Effective } L_{50}) =$ **12.58**
 Climate zone is: **UK**

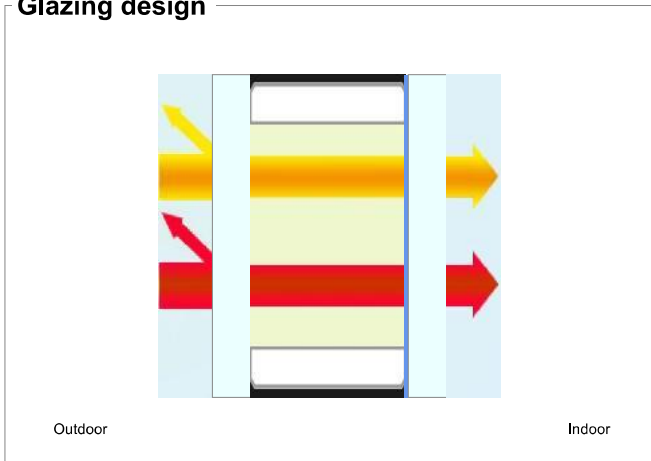
Thermal transmittance, W/(m ² K)	U_{window}	1.4
Solar factor	g_{window}	0.49
Window air leakage heat loss, W/(m ² K)	L_{factor}	0.02

Simulator Name: **Steve Wright**



BFRC Certified Simulator **044**

Glazing design



	First glazing	Second glazing
Gas		Argon 90% 16.00mm
Coating		PLANITHERM TOTAL+
First glass	PLANICLEAR 4.00mm	PLANICLEAR 4.00mm
Coating		
Layer		
Coating		
Second glass		
Coating		

Manufacturing sizes

Nominal thickness : **24.0 mm**
Weight : **20.0 kg/m²**

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

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

Energy factors (EN410-2011) :

Transmittance : **64 %**
Outdoor reflectance : **20 %**
Indoor reflectance : **20 %**
Absorptance A1 : **6 %**
Absorptance A2 : **9 %**

Solar factors (EN410-2011) :

g : **0.73**
Shading coefficient : **0.83**

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

U_g : **1.2 W/(m².K)**



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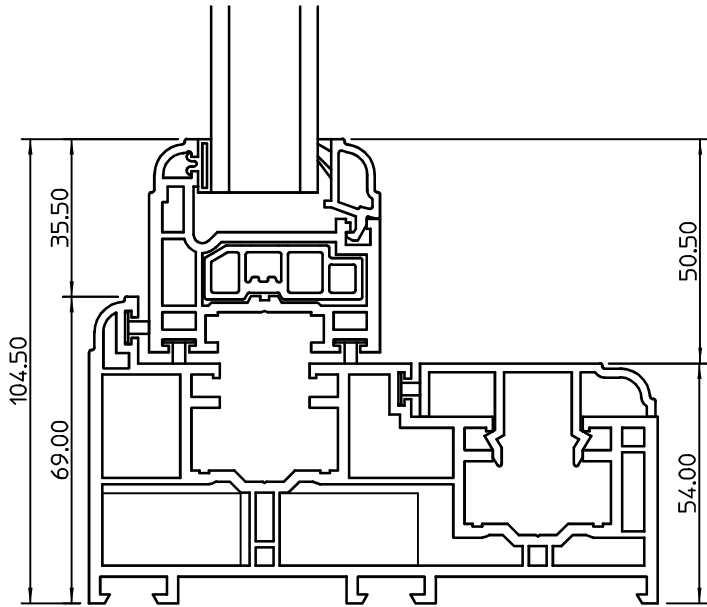
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CALUMEN® II is a simulation software to calculate key performance of glass such as light transmission, solar factor or thermal insulation coefficient. Computed values are indicative and subject to change. They can not be used to guarantee performance of the products.

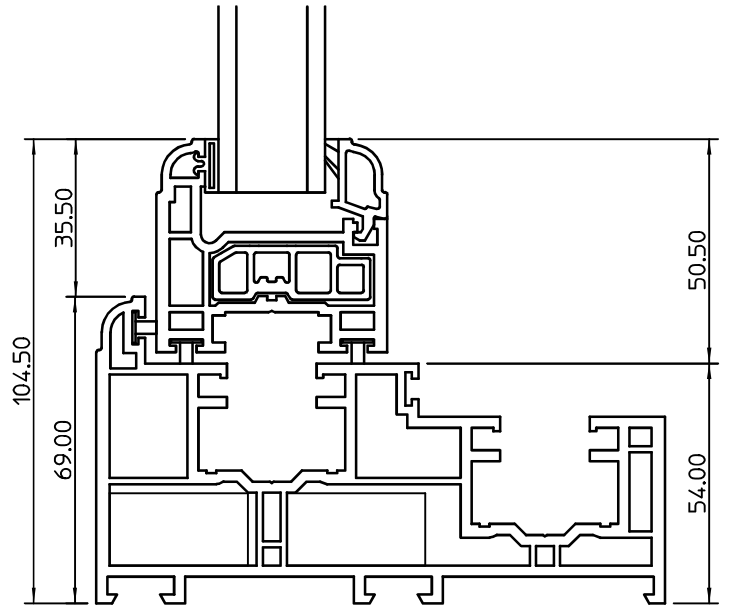
These values are calculated according to EN410-2011 and EN673-2011 standards. Tolerances are defined according to EN 1096-4 or ISO9050-2003 standards. Nevertheless, user must check the feasibility of the associated products, in particular in terms of thickness and colour. Furthermore, it is his responsibility 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

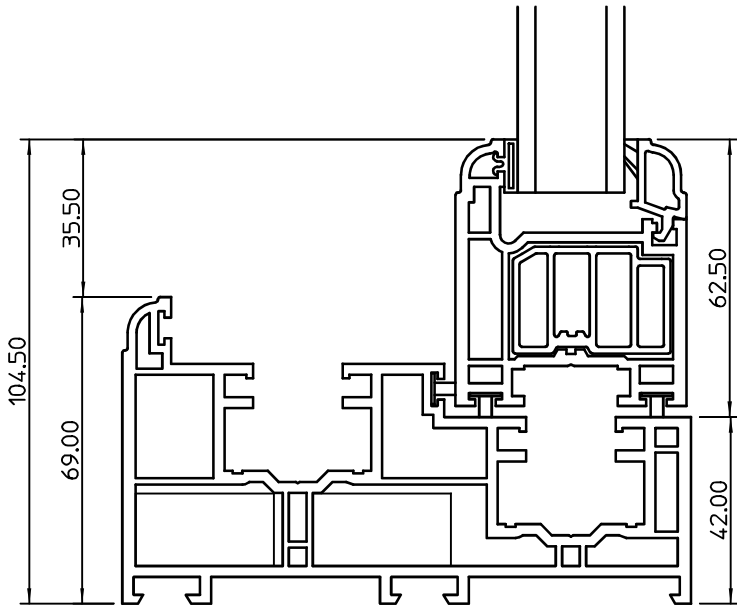




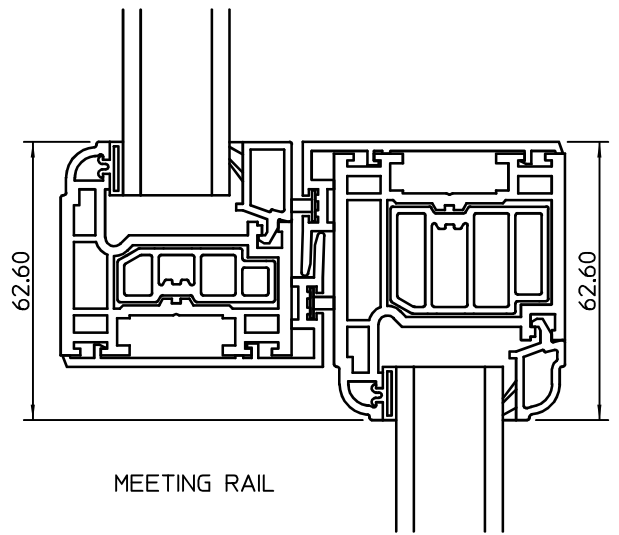
TOP RAIL



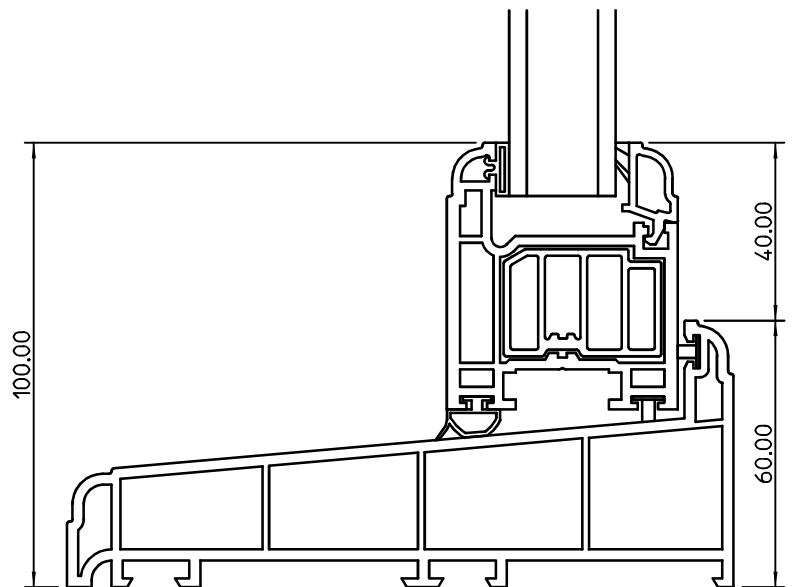
TOP JAMB



BOTTOM JAMB



MEETING RAIL



BOTTOM RAIL



Test Report: W10250

Classification of Weathertightness in accordance with BS 6375-1:2009

Incorporating Air Permeability test in accordance with BS EN 1026:2000

Watertightness test in accordance with BS EN 1027:2000 and Resistance to wind load in accordance with BS EN 12211:2000

Specimen type: Window - vertical slider
Vertical Slider

Client Spectus Window Systems

Address Snape Road
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Date 13 August 2010

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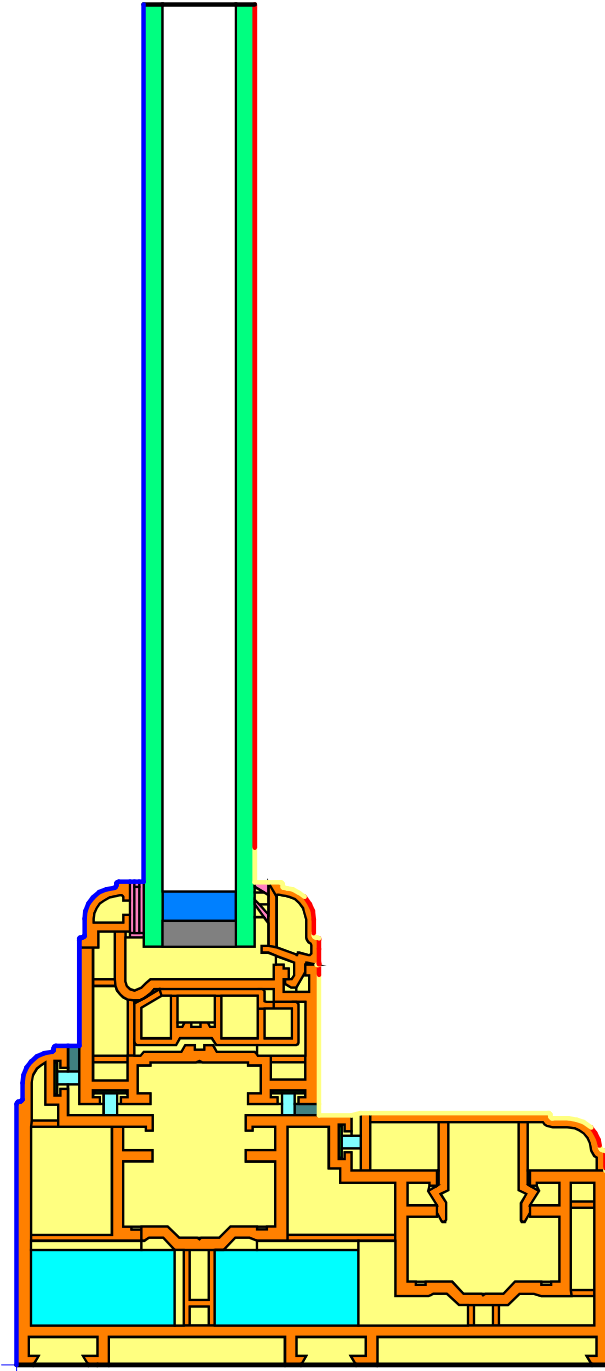
Software issue ref: July 2010

Appendix 1 - Air permeability data

1st test - positive pressure					
Pressure	Chamber permeability	Total Permeability	Net perm, adjusted for conditions	Net permeability per m ² area	Net permeability per m opening length
(Pa)	(m ³ /h)	(m ³ /h)	(m ³ /h)	(m ³ /h m ²)	(m ³ /h m)
50	3.30	5.50	2.13	1.17	0.34
100	5.17	9.00	3.71	2.04	0.59
150	7.02	12.26	5.07	2.79	0.81
200	8.59	15.34	6.53	3.59	1.05
250	10.11	18.13	7.76	4.26	1.24
300	11.55	20.89	9.04	4.97	1.45
450	16.21	29.41	12.77	7.02	2.05
600	21.59	38.76	16.62	9.13	2.66

1st test - negative pressure					
Pressure	Chamber permeability	Total Permeability	Net perm, adjusted for conditions	Net permeability per m ² area	Net permeability per m opening length
(Pa)	(m ³ /h)	(m ³ /h)	(m ³ /h)	(m ³ /h m ²)	(m ³ /h m)
50	3.29	5.20	1.85	1.02	0.30
100	5.12	8.51	3.28	1.80	0.53
150	6.70	11.40	4.55	2.50	0.73
200	8.08	13.96	5.69	3.13	0.91
250	9.32	16.28	6.74	3.70	1.08
300	10.45	18.42	7.71	4.24	1.24
450	13.48	24.29	10.46	5.75	1.68
600	16.10	29.72	13.18	7.24	2.11

Average between positive and negative pressure -1st test						
Air pressure	Positive pressure		Negative pressure		Mean	
	Net Permeability per m ² area	Net Permeability per m opening length	Net Permeability per m ² area	Net Permeability per m opening length	Per m ² area	Per m opening length
(Pa)	(m ³ /h m ²)	(m ³ /h m)	(m ³ /h m ²)	(m ³ /h m)	(m ³ /h m)	(m ³ /h m)
50	1.17	0.34	1.02	0.30	1.09	0.32
100	2.04	0.59	1.80	0.53	1.92	0.56
150	2.79	0.81	2.50	0.73	2.64	0.77
200	3.59	1.05	3.13	0.91	3.36	0.98
250	4.26	1.24	3.70	1.08	3.98	1.16
300	4.97	1.45	4.24	1.24	4.60	1.34
450	7.02	2.05	5.75	1.68	6.38	1.86
600	9.13	2.66	7.24	2.11	8.18	2.39




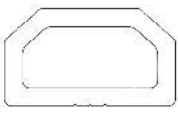
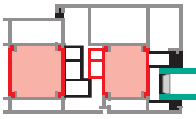
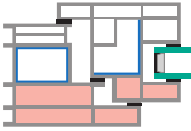

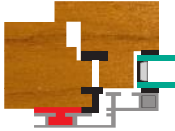
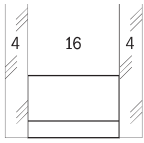
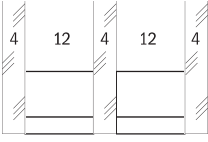
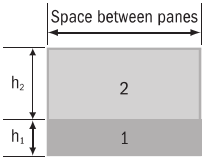


Data sheet Psi values for windows

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



Thermoseal Group Ltd
 Gavin Way, Nexus Point,
 Off Holford Drive
 Birmingham B6 7AF, United Kingdom

	Product name		Spacer height in mm	Material	Thickness d in mm
Cross-section	 Thermobar™ Warm Edge Spacer Films		6.5	modified polypropylene glass filled / modified polyester film	1.0 / 1.2 0.027
Representative frame profile		Metal with thermal break 	Plastic 	Wood 	Wood / Metal 
Representative psi value double-sheet thermally insulating glass W/mK	 Double-sheet insulating glass $U_g=1.1 \text{ W/m}^2\text{K}$	0.036	0.032	0.031	0.032
Representative psi value triple-sheet thermally insulating glass W/mK	 Triple-sheet insulating glass $U_g=0.7 \text{ W/m}^2\text{K}$	0.031	0.030	0.029	0.030
Two Box model Characteristic values		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-17/1 "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 UW 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-08/2 "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 "Compass 'Warm Edge' for Windows" of Bundesverband Flachglas.

Characteristic values determined by:

Hochschule **Rosenheim**
University of Applied Sciences



MATERIAL THERMAL CONDUCTIVITY VALUES

MATERIAL	λ value W/m-K	SOURCE
Aluminium (Si Alloys)	160	EN ISO 10077-2
Butyl Solid / Hot Melt	0.24	EN ISO 10077-2
EPDM	0.25	EN ISO 10077-2
EPS 70	0.038	Manufacturer test data
Glass	1	EN ISO 10077-2
GRP SKIN 0.4	0.4	EN ISO 10077-2
Hardwood	0.18	EN ISO 10077-2
CEN Insulation Panel	0.035	EN ISO 10077-2 (Annex C)
MDF (0.14)	0.14	EN ISO 12524
MDF (0.18)	0.18	EN ISO 12524
Pile Weather Stripping (polyester mohair)	0.14	EN ISO 10077-2
Molecular Sieve (dessicant)	0.1	EN ISO 10077-2
Plywood (0.24)	0.24	EN ISO 12524
Polyamide (nylon)	0.25	EN ISO 10077-2
Polyamide 6.6	0.3	EN ISO 10077-2
Polycarbonate	0.2	EN ISO 10077-2
Polyethylene HD	0.5	EN ISO 10077-2
Polyisobutylene	0.2	EN ISO 10077-2
Polypropylene, solid	0.22	EN ISO 10077-2
Polysulfide	0.4	EN ISO 10077-2
PU (polyurethane)	0.4	EN ISO 10077-2
PVC, flexible (PVC-P)	0.14	EN ISO 10077-2
PVC, rigid (PVC-U)	0.17	EN ISO 10077-2
Silica Gel (dessicant)	0.13	EN ISO 10077-2
Silicone, pure	0.35	EN ISO 10077-2
Softwood	0.13	EN ISO 10077-2
Stainless Steel	17	EN ISO 10077-2
Steel	50	EN ISO 10077-2