

ENERGY RATING REPORT



REPORT NUMBER: 2638 Page 1 of 10

Window System	Spectus Vertical Slider
Size	1230mm x 1480mm
Frame Material	PVC-U
Outer Frame Reference	VS41
Outer Frame Reinforcement	N/A
Top Sash Reference	VS03 (48mm)
Top Sash Reinforcement	VSR3S (Steel), VSX03 (PVC-U) head and jambs
Bottom Sash Reference	VS04 (60mm)
Bottom Sash Reinforcement	VSR44S (Steel), VSX04 (PVC-U) in jambs
Bottom Rail	VS04 (60mm)
Bottom Rail Reinforcement	VSR44S (Steel)
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

RESULTS

BFRC ENERGY RATING BAND	A	
BFRC Energy Rating Index	9	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: Greg Glynn (Certified Simulator No. 075)
Designer
Spectus Window Systems

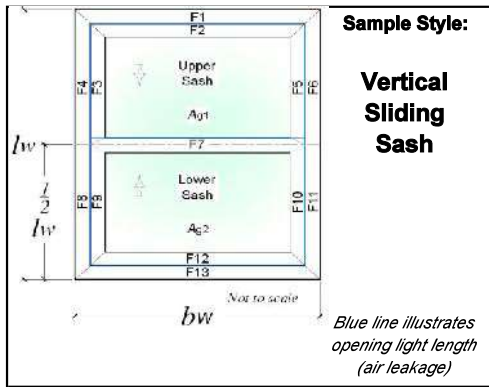
Signed:

Date: 18th March 2022



**BFRC Certified
Simulator 075**

*The simulations in this report were performed using WinIso® 2.7.8
In accordance substantially with BS EN ISO 10077-2:2017
using the radiosity method for the treatment of cavities.*



Report Number: 2638
Report Date: 18/03/2022

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

Project Details: VS with RCM & Steel & VS04 Btm Rail 4/16/4
Planiclear - Argon - Planitherm Total+ with Thermobar

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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	mm
Total window width ODP	b_w	mm

Frame offset: No

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

Glazing dimensions and properties:

Thickness of pane 1, d_{p1}	4.0	mm
Glazing fill thickness 1/2, d_{gf1}	16.0	mm
Gas fill (1/2)	Argon 90%	
Thickness of pane 2, d_{p2}	4.0	mm
Complete next 3 cells for TG IGU		
Glazing fill thickness 2/2, d_{gf2}		mm
Gas fill (2/3)		
Thickness of pane 3, d_{p3}		mm
Glazing Trans. - 3DP	U_g	1.195 W/(m ² ·K)
g-value - 2DP	g_L	0.73

Thermal transmittance of window from hot box test

U_w - **2DP** W/(m²·K)

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

Solar Factor, g-value:	glazing area A_g (m ²)	1.3556
	F_w	0.9
	g_w	0.49

U_{window}	No bars; or attached bars	1.41
	Single cross bar in IGU	1.5
	Multiple cross bar in IGU	1.6
	Glazing bar (Georgian bar)	1.8

BFRC Rating	Label	EWER	Window
kWh/(m ² ·yr)	Index	Rating Scale	Rating
≥10		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 (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	69	n/a	54.0	105.0
F2 moving top rail	51	36	0.0	51.0	
F3 top (LH) jamb (moving sash)	51	36	0.0	51.0	105.0
F4 top (LH) jamb (fixed frame)	54	69	n/a	54.0	
F5 top (RH) jamb (moving sash)	51	36	0.0	51.0	105.0
F6 top (RH) jamb (fixed frame)	54	69	n/a	54.0	
F7 mid rail	63		0.0	63.0	63.0
			0.0		
F8 bottom (LH) jamb (fixed frame)	54	69	n/a	54.0	105.0
F9 bottom (LH) jamb (moving sash)	51	36	0.0	51.0	
F10 bottom (RH) jamb (moving sash)	51	36	0.0	51.0	105.0
F11 bottom (RH) jamb (fixed frame)	54	69	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	

Where a U_w value from hot box testing is available, no L_f^{2D} or L_ψ^{2D} values need to be entered					
Frame conductance:		All L values to 4DP . All b values to ODP			
		$W/(m^2 \cdot K)$	b_g (mm)	$W/(m^2 \cdot K)$	b_g (mm)
F1+F2 top rail	L_f^{2D}	0.3508	190	0.3870	190
F3+F4 top (LH) jamb		0.3614	190	0.3978	190
F5+F6 top (RH) jamb		0.3614	190	0.3978	190
F7 mid rail		0.5933	380	0.6695	380
F8+F9 bottom (LH) jamb		0.3611	190	0.3977	190
F10+F11 bottom (RH) jamb	L_ψ^{2D}	0.3611	190	0.3977	190
F12+F13 bottom rail		0.3964	190	0.4320	190

Frame:	Frame width, b_f	Frame U-value, U_f	Frame areas, A_f	Frame heat flow, HU	Linear trans, ψ	Linear length, l_g	Junction heat flow, H_ψ
Section	m	W/(m ² ·K)	m ²	W/K	W/(m·K)	m	W/K
F1+F2 top rail	0.1050	1.2263	0.1181	0.1449	0.0312	1.0200	0.0318
F3+F4 top left jamb	0.1050	1.3273	0.0714	0.0947	0.0314	0.6035	0.0189
F5+F6 top right jamb	0.1050	1.3273	0.0714	0.0947	0.0314	0.6035	0.0189
F7 mid rail	0.0630	2.3687	0.0675	0.1598	0.0662	1.0200	0.0675
F8+F9 btm left jamb	0.1050	1.3244	0.0712	0.0943	0.0316	0.6085	0.0192
F10+F11 btm right jamb	0.1050	1.3244	0.0712	0.0943	0.0316	0.6085	0.0192
F12+F13 bottom rail	0.1000	1.7436	0.1134	0.1977	0.0306	1.0200	0.0312
Totals		0.5842	0.8805			Total	0.2068

Air Leakage loss:

Air leakage at 50 Pa per hour & per unit length of opening light (BS 6375-1) - 2DP				0.32	m ³ /(m·h)
Opening light length, $l_{opening}$	6.3700	m	Total air leakage	2.038	m ³ /h
L_{50}	1.12	m ³ /(m ² ·h)	Heat loss = 0.0165 L_{50}	0.02	W/(m ² ·K)

Other parameters needed for calculation, taken from simulations:					
$d_p = d_g =$	0.024	m	$R_{se} =$	0.13	m ² ·K/W
$\lambda_p =$	0.035	W/(m·K)	$R_{tot} =$	0.8557	m ² ·K/W
$R_p =$	0.6857	m ² ·K/W	$U_p =$	1.1686	W/(m ² ·K)

BFRC Rating =	
218.6g_{window} - 68.5 x (U_{window} + Effective L_{50}) =	9.16
Climate zone is:	UK

Thermal transmittance, W/(m²·K)	U_{window}	1.4
Solar factor	g_{window}	0.49
Window air leakage heat loss, W/(m²·K)	L_{factor}	0.02

Simulator Name: Greg Glynn



BFRC Certified Simulator 075

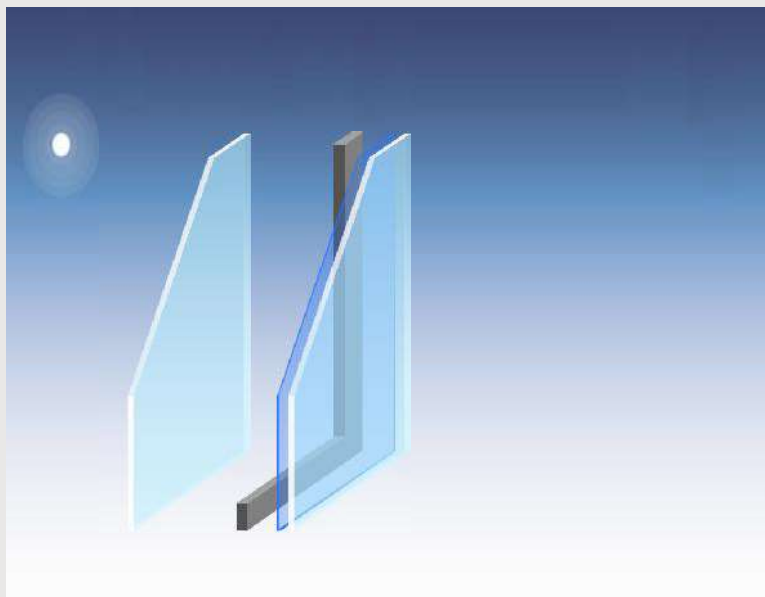
Number of spaces
1

Spaces		1
Glazing orientation	Vertical	
Resistivity panes	1	m·K/W
Outside		
90%		
P a n e 1		
P a n e 2		
Gas		
Argon		
Thickness (mm)	4.0	16 4.0
Normal emissivity	0.89	0.05
$\sum d_j \cdot \epsilon_j$	0.008	Uncoated

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

External, R_{se}	0.04	(m ² ·K)/W
Internal, R_{si}	0.13	(m ² ·K)/W
Iteration number	U value	$\sum 1/h_s$
1	W/(m ² ·K)	(m ² ·K)/W
2	1.195	0.65864
	1.195	0.65864

λ_{eff}	ΔT
W/(mK)	
0.0243	15
0.0243	15



Glazing 1	PLANICLEAR 4 mm
Cavity 1	Argon 90% 16 mm
Glazing 2	PLANITHERM TOTAL+ FG PLANICLEAR 4 mm

Last name: Greg Glynn
Country: United Kingdom

Notes: WER Report 2638

LUMINOUS FACTORS EN410 (2011-04)

Light Transmittance (TL)	79 %
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	24.00 mm
Weight	20.0 kg/m²

ACOUSTICS EN 12758

<i>Acoustic values according to EN 12758 and from notified body</i>	
Rw (C;Ctr)	31 (-1; -4) dB
STC (ASTM E413)	N/A
OITC (ASTM E1332)	N/A

SAFETY CLASS EN 12600

Pendulum Body Resistance	NPD
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ENERGY FACTORS EN410 (2011-04)

Transmittance (TE)	64 %
Outdoor Reflectance (Ree)	20 %
Indoor Reflectance (Rei)	21 %
Absorptance A1 (AE1)	6 %
Absorptance A2 (AE2)	9 %

SOLAR FACTORS EN410 (2011-04)

Solar Factor (g)	0.73
Shading Coefficient (SC)	0.83

COLOR RENDERING

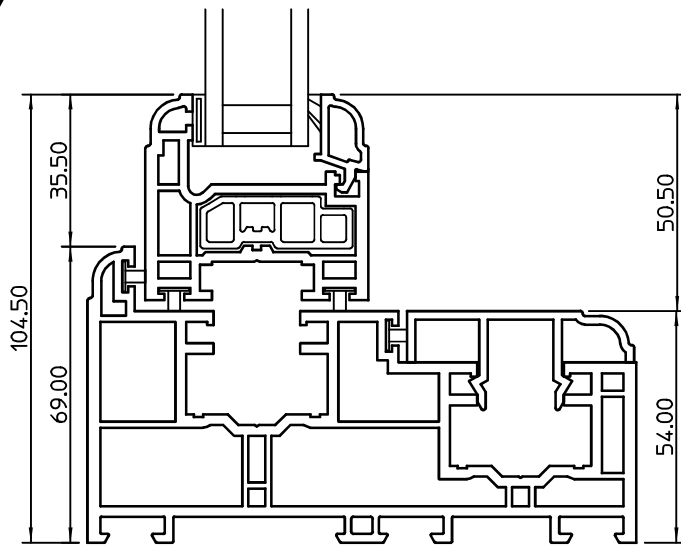
Transmission (Ra)	99
Reflection (Ra)	90

ANTI-BURGLARY EN 356

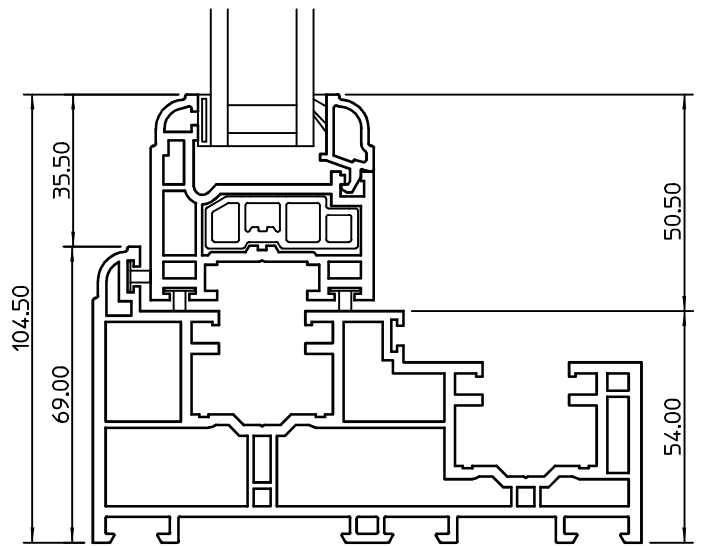
Burglar Resistance	NPD
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CARBON FOOTPRINT EN 15804+A2

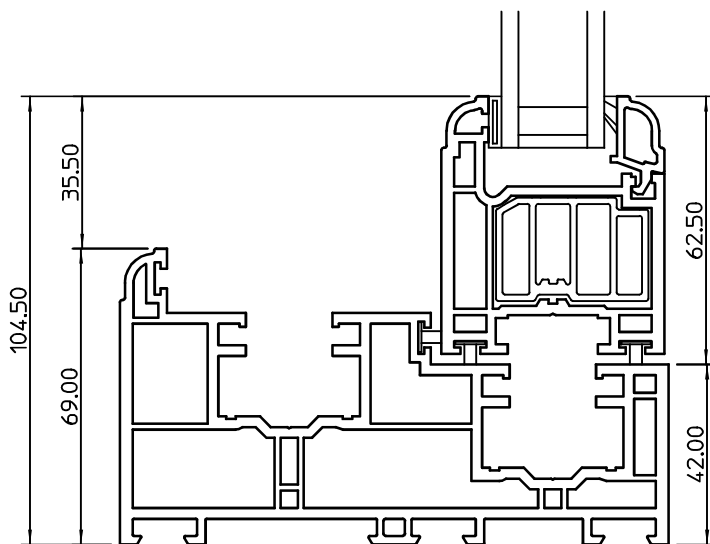
Global Warming Potential (GWP)	32.92
(kg, CO ₂ equiv/m²) European average	



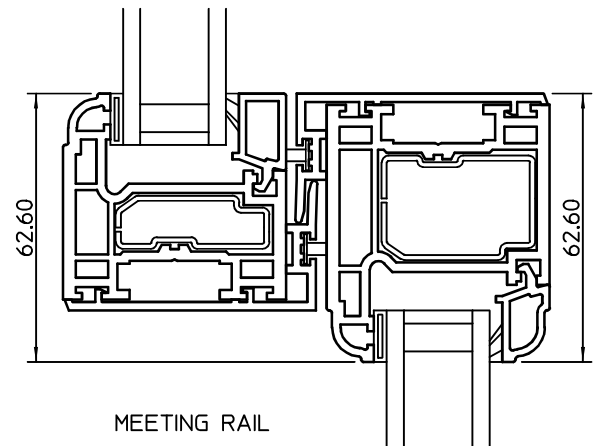
TOP RAIL



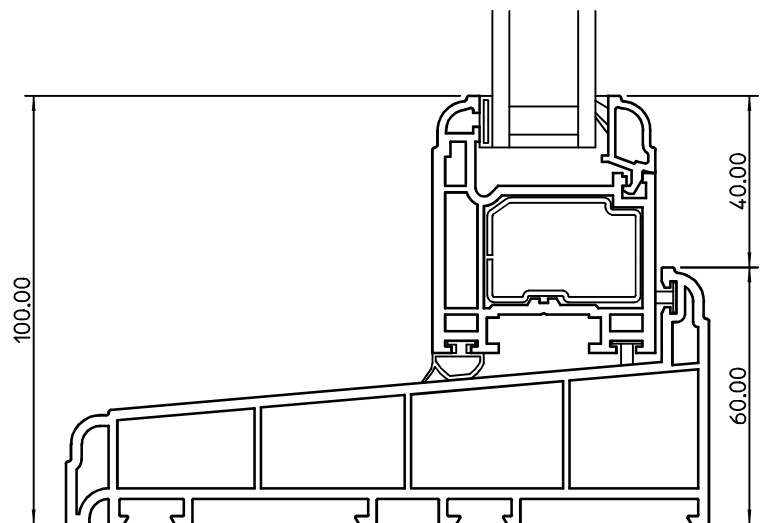
TOP JAMB



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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Cheshire
SK10 2NZ

Date 13 August 2010

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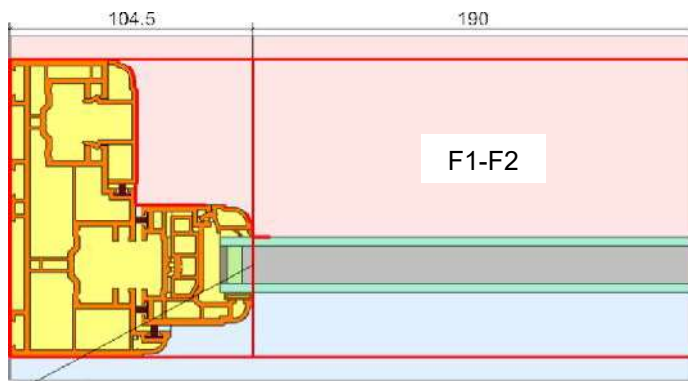
Software issue ref: July 2010

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

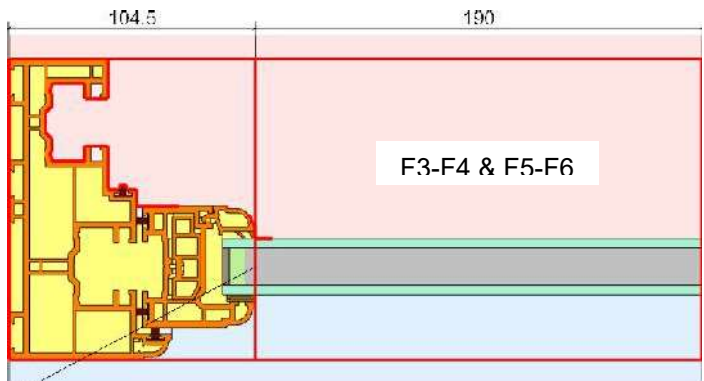
Average between positive and negative pressure - 1st test						
Air pressure	Positive pressure		Negative pressure		Mean	
	Net Permeability per m ² area	Net Permeability per m opening length	Net Permeability per m ² area	Net Permeability per m opening length	Per m ² area	Per m opening length
(Pa)	(m ³ /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



$$U_f = \frac{L^{2D} - U_p \cdot b_p}{b_f} = \frac{0.3508 - 1.1686 \cdot 0.19000}{0.10450} = 1.2 \text{ (1.2321)} \frac{W}{m^2K}$$

$$\Psi_g = L^{2D} - U_f \cdot b_f - U_g \cdot b_g = 0.3870 - 1.2321 \cdot 0.10450 - 1.1950 \cdot 0.19000 = 0.031 \text{ (0.0312)} \frac{W}{m^2K}$$

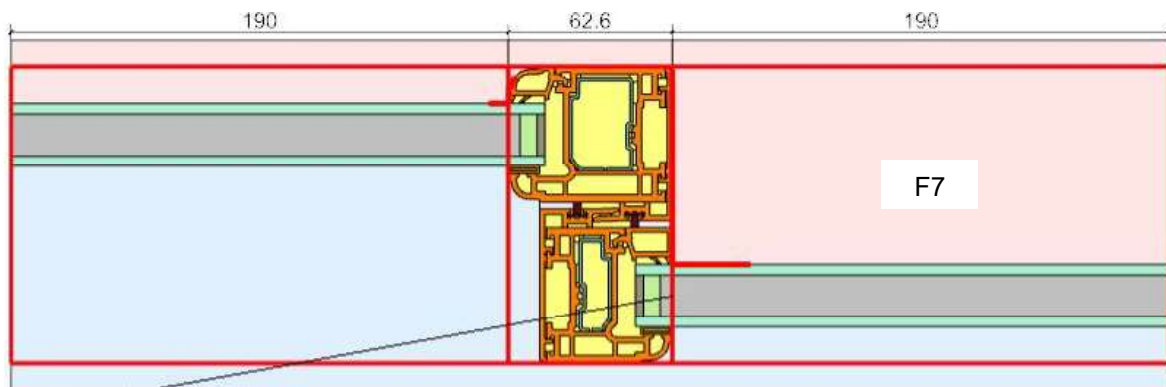
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$$U_f = \frac{L^{2D} - U_p \cdot b_p}{b_f} = \frac{0.3614 - 1.1686 \cdot 0.19000}{0.10450} = 1.3 \text{ (1.3338)} \frac{W}{m^2K}$$

$$\Psi_g = L^{2D} - U_f \cdot b_f - U_g \cdot b_g = 0.3978 - 1.3338 \cdot 0.10450 - 1.1950 \cdot 0.19000 = 0.031 \text{ (0.0314)} \frac{W}{m^2K}$$

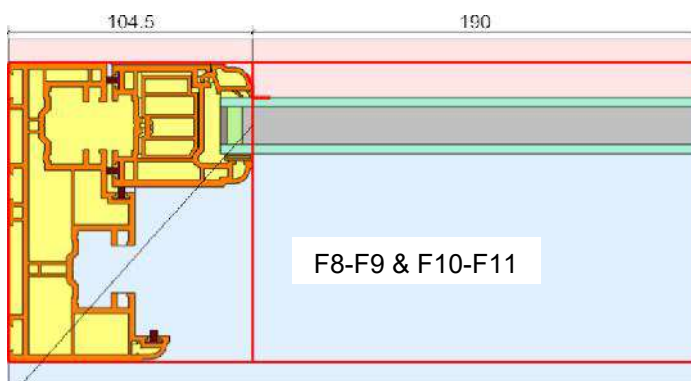
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$$U_f = \frac{L^{2D} - U_p \cdot b_p}{b_f} = \frac{0.5933 - 1.1686 \cdot 0.19000 - 1.1686 \cdot 0.19000}{0.06260} = 2.4 \text{ (2.3840)} \frac{W}{m^2K}$$

$$\Psi_g = L^{2D} - U_f \cdot b_f - U_g \cdot b_g = 0.6695 - 2.3840 \cdot 0.06260 - 1.1950 \cdot 0.19000 - 1.1950 \cdot 0.19000 = 0.066 \text{ (0.0662)} \frac{W}{m^2K}$$

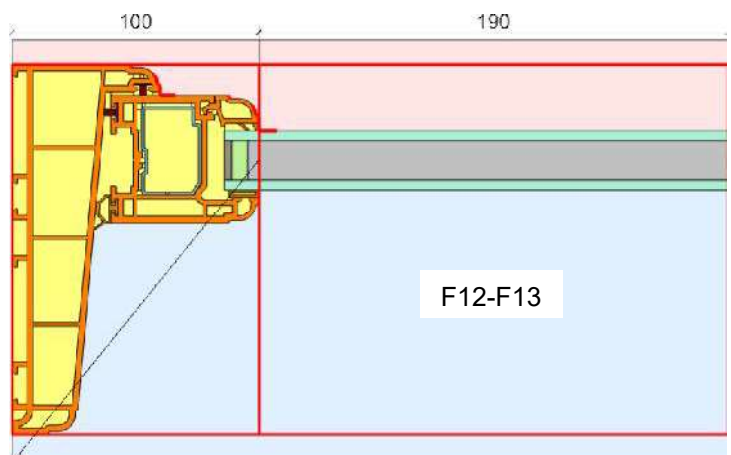
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$$U_f = \frac{L^{2D} - U_p \cdot b_p}{b_f} = \frac{0.3611 - 1.1686 \cdot 0.19000}{0.10450} = 1.3 \text{ (1.3308)} \frac{W}{m^2K}$$

$$\Psi_g = L^{2D} - U_f \cdot b_f - U_g \cdot b_g = 0.3977 - 1.3308 \cdot 0.10450 - 1.1950 \cdot 0.19000 = 0.032 \text{ (0.0315)} \frac{W}{m^2K}$$

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$$U_f = \frac{L^{2D} - U_p \cdot b_p}{b_f} = \frac{0.3964 - 1.1686 \cdot 0.19000}{0.10000} = 1.7 \text{ (1.7441)} \frac{W}{m^2K}$$

$$\Psi_g = L^{2D} - U_f \cdot b_f - U_g \cdot b_g = 0.4320 - 1.7441 \cdot 0.10000 - 1.1950 \cdot 0.19000 = 0.031 \text{ (0.0305)} \frac{W}{m^2K}$$

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Psi values for windows

Determination of the equivalent thermal conductivity of spacers by measurement



November 2021 – Document Ref: CU21618-1

For	Spacer name	Technical Drawing
Thermoseal Group Ltd Gavin Way Nexus Point Off Holford Drive Birmingham B6 7AF	Thermobar Spacer (For use with polysulfide/ polyurethane sealant)	

Dimensions (mm)	Description	Thickness (mm)
6.5 high x 15.5 wide	Polypropylene 40% Glass filled spacer with a polyester film acrylic adhesive tape	1.2 0.027

Representative Psi value

	 Double-glazing - $U_g = 1.1 \text{ W/m}^2\text{K}$	 Triple-glazing - $U_g = 0.74 \text{ W/m}^2\text{K}$
 Metal with thermal break	0.036 W/mK	0.031 W/mK
 Plastic	0.032 W/mK	0.031 W/mK
 Wood	0.030 W/mK	0.029 W/mK
 Wood and Metal	0.032 W/mK	0.030 W/mK

Two box model characteristic values

Space between panes (mm)		$\lambda_{eq,2B}$ in W/mK	
		Spacer - height1 = 6.5mm	Sealant - height2 = 3mm
Valid for all spacer widths		0.14	0.40

This report follows the principles of IFT guideline WA-17/1 "Thermally improved spacers – Determination of the equivalent thermal conductivity by measurement" and IFT guideline WA-08/2 "Thermally improved spacers – Part 1: Determination of the representative Psi value for window frame profiles".

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MATERIAL THERMAL CONDUCTIVITY VALUES

MATERIAL	λ value W/m-K	SOURCE	EMISSIONITY
Aluminium (Si Alloys) (painted)	160	EN ISO 10077-2	0.9
Aluminium (Si Alloys) (unpainted)	160	EN ISO 10077-2	0.3
Butyl Solid / Hot Melt	0.24	EN ISO 10077-2	0.9
EPDM	0.25	EN ISO 10077-2	0.9
EPS 70	0.038	BS EN 13163 (& manufacturer)	0.9
Glass	1.0	EN ISO 10077-2	0.9
GRP SKIN 0.4	0.4	EN ISO 10077-2	0.9
Hardwood	0.18	EN ISO 10077-2	0.9
CEN Insulation Panel	0.035	EN ISO 10077-2 (Annex C)	0.9
MDF (0.14)	0.14	EN ISO 12524	0.9
MDF (0.18)	0.18	EN ISO 12524	0.9
Pile Weather Stripping (polyester mohair)	0.14	EN ISO 10077-2	0.9
Molecular Sieve (dessicant)	0.1	EN ISO 10077-2	0.9
Plywood (0.24)	0.24	EN ISO 12524	0.9
Polyamide (nylon)	0.25	EN ISO 10077-2	0.9
Polyamide 6.6	0.3	EN ISO 10077-2	0.9
Polycarbonate	0.2	EN ISO 10077-2	0.9
Polyethylene HD	0.5	EN ISO 10077-2	0.9
Polyisobutylene	0.2	EN ISO 10077-2	0.9
Polypropylene, solid	0.22	EN ISO 10077-2	0.9
Polysulfide	0.4	EN ISO 10077-2	0.9
PU (polyurethane)	0.4	EN ISO 10077-2	0.9
PVC, flexible (PVC-P)	0.14	EN ISO 10077-2	0.9
PVC, rigid (PVC-U)	0.17	EN ISO 10077-2	0.9
Silica Gel (dessicant)	0.13	EN ISO 10077-2	0.9
Silicone, pure	0.35	EN ISO 10077-2	0.9
Softwood	0.13	EN ISO 10077-2	0.9
Stainless Steel	17	EN ISO 10077-2	0.3
Steel	50	EN ISO 10077-2	0.3