

## WINDOW ENERGY RATING REPORT - SHEET 1 OF 5



**Report Reference :**

MVS	C	-16	1.6
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**Window System :** VEKA - Matrix Vertical Sliding Window

**Window Description :** Multi-chambered, Steel Reinforced, PVC-U Window

### Calculation Data

Window designs in accordance with GGF Data Sheet 2.2 & BFRC Simulator's Manual.  
Thermal simulations substantially in agreement with BS EN ISO 10077 – 2 using LBL software: Therm 5.2.

Thermal conductivity figures taken from BS EN 10077 – 2 unless otherwise stated.

Whole window U-values calculated in accordance with BS EN 10077 – 1.

### Window Specification

Member	VEKA plc Profile Number	VEKA plc Reinforcement Number
Frame	105036	113040
Cill	105037	113321
Upper Sash	105032	113020 & SIM 720-A
Lower Sash	105033	113314 & LPSIM125
Bead	107169 & 107118	N.A.
Weather Seal	112107	N.A.
Glazing Gasket	112279	N.A.
Bead Gasket	N.A.	N.A.

### Glazing Specification

Outer Pane	Cavity Gas	Spacer Bar	Inner Pane
4mm Clear Float Glass	20mm	Standard Aluminium	4mm Low En = 0.05
Saint-Gobain - Planilux	Argon @ 90%	Secondary Seal Polysulfide 6mm	Saint-Gobain - Total +

Air Leakage Report	VEKA plc	Date	Positive Only	0.50	m <sup>3</sup> /(m <sup>2</sup> ·h)
	WT 026	15/04/2008	Positive Only	0.20	m <sup>3</sup> /(m·h)

### Window Energy Rating Summary

Glazing Emissivity	0.05	Glazing U-value	1.2 W/(m <sup>2</sup> ·K)
Glazing g-value	0.71	Whole Window g-value	0.43
Whole Window U-value	1.6 W/(m <sup>2</sup> ·K)	Air Leakage Heat Loss	0.010 W/(m <sup>2</sup> ·K)
<b>Window Energy Index</b>	<b>-16 kWh/(m<sup>2</sup>·year)</b>	<b>Window Energy Rating</b>	<b>C</b>

Simulated by: T.J. Williams	Date: 03/08/2010	Signature: <i>T.J. Williams</i>
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## Material Thermal Conductivity

Material	Thermal Conductivity	Material	Thermal Conductivity
Aluminium	160.00 W/(m·K)	Desiccant	0.10 W/(m·K)
Elastomeric Foam	0.05 W/(m·K)	EPDM	0.25 W/(m·K)
Glass	1.00 W/(m·K)	Panel	0.035 W/(m·K)
PIB (Primary)	0.20 W/(m·K)	Pile	0.14 W/(m·K)
Polysulfide	0.40 W/(m·K)	Polyurethane	0.25 W/(m·K)
PVC (Flexible)	0.14 W/(m·K)	Polypropylene	0.22 W/(m·K)
Silicone	0.35 W/(m·K)	PVC-U (Rigid)	0.17 W/(m·K)
Stainless Steel	17.00 W/(m·K)	Solid Butyl (Secondary)	0.24 W/(m·K)
LB-X	0.029 W/(m·K)	Steel	50.00 W/(m·K)

All emissivities are 0.9.

## Spacer Bar Thermal Conductivity

Manufacturer	Product	Width	Thermal Conductivity
Edgetech	SuperSpacer	20mm	0.122 W/(m·K)
Saint Gobain	SwisSpacer V Resin	20mm	0.160 W/(m·K)
Saint Gobain	SwisSpacer V Resin+Stl	20mm	0.289 W/(m·K)
Technoform	TGI Polypropylene+Stl	20mm	1.063 W/(m·K)
Thermoseal	Thermix Polypropylene+Stl	20mm	1.690 W/(m·K)

Information supplied by product manufacturer. All emissivities are 0.9.

## Boundary Conditions

Description	Model	Temperature	Film Coefficient
Adiabatic	N.A.	0 °C	0.00
CEN External	Simplified	0 °C	25.00
CEN Internal	Simplified	20 °C	7.69
CEN Sheltered Internal	Simplified	20 °C	5.00

## Frame Cavities

Description	Radiation Model	Cavity Model	Gas	Emissivities
Unventilated	Simplified	CEN	Air	Side 1 & 2 = 0.9
Slightly Ventilated	Simplified	CEN	Air	Side 1 & 2 = 0.9
Reinforcement	Detailed	CEN	Air	Side 1 & 2 = 0.9

## Glazing Performance Data

### Double Glazing - 28mm

Up 1031

Manufacturer	Product	Inner	Gas Space	Gas Conductivity	Outer	Ug	g
AGC Flatglass	Planibel N+T	En = 0.03	20mm Air	0.0370	Clear	1.396	0.64
			20mm Argon	0.0289	Low Iron	1.151	0.68
AGC Flatglass	Planibel N	En = 0.03	20mm Air	0.0370	Clear	1.396	0.61
			20mm Argon	0.0289	Low Iron	1.151	0.64
Euroglas	Silverstar Enplus	En = 0.03	20mm Air	0.0370	Clear	1.396	0.61
			20mm Argon	0.0289	Low Iron	1.151	0.64
Euroglas	S3 Neutral Low E	En = 0.03	20mm Air	0.0370	Clear	1.396	0.63
			20mm Argon	0.0289	Low Iron	1.151	-
Interpane	iplus E	En = 0.03	20mm Air	0.0370	Clear	1.396	0.62
			20mm Argon	0.0289	Low Iron	1.151	-
Pilkington	Optitherm S3	En = 0.03	20mm Air	0.0370	Clear	1.396	0.61
			20mm Argon	0.0289	Low Iron	1.151	0.65
Saint-Gobain	Planitherm Ultra N	En = 0.03	20mm Air	0.0370	Clear	1.428	0.63
			20mm Argon	0.0289	Low Iron	1.151	0.67

Manufacturer	Product	Inner	Gas Space		Outer	Ug	g
Guardian	Climaguard N	En = 0.04	20mm Air	0.0382	Clear	1.428	0.64
			20mm Argon	0.0300	Low Iron	1.187	0.67
Pilkington	Optitherm SN	En = 0.04	20mm Air	0.0382	Clear	1.428	0.63
			20mm Argon	0.0300	Low Iron	1.187	0.67
Pilkington	Optitherm S4	En = 0.04	20mm Air	0.0382	Clear	1.428	0.66
			20mm Argon	0.0300	Low Iron	1.187	0.71
Saint-Gobain	Planitherm Total	En = 0.04	20mm Air	0.0382	Clear	1.428	0.66
			20mm Argon	0.0300	Low Iron	1.187	0.71

Manufacturer	Product	Inner	Gas Space		Outer	Ug	g
Guardian	Climaguard A	En = 0.05	20mm Air	0.0393	Clear	1.459	0.68
			20mm Argon	0.0311	Low Iron	1.221	0.70
Saint-Gobain	Planitherm Total +	En = 0.05	20mm Argon	0.0311	Clear	1.221	0.71
					Low Iron	0.74	

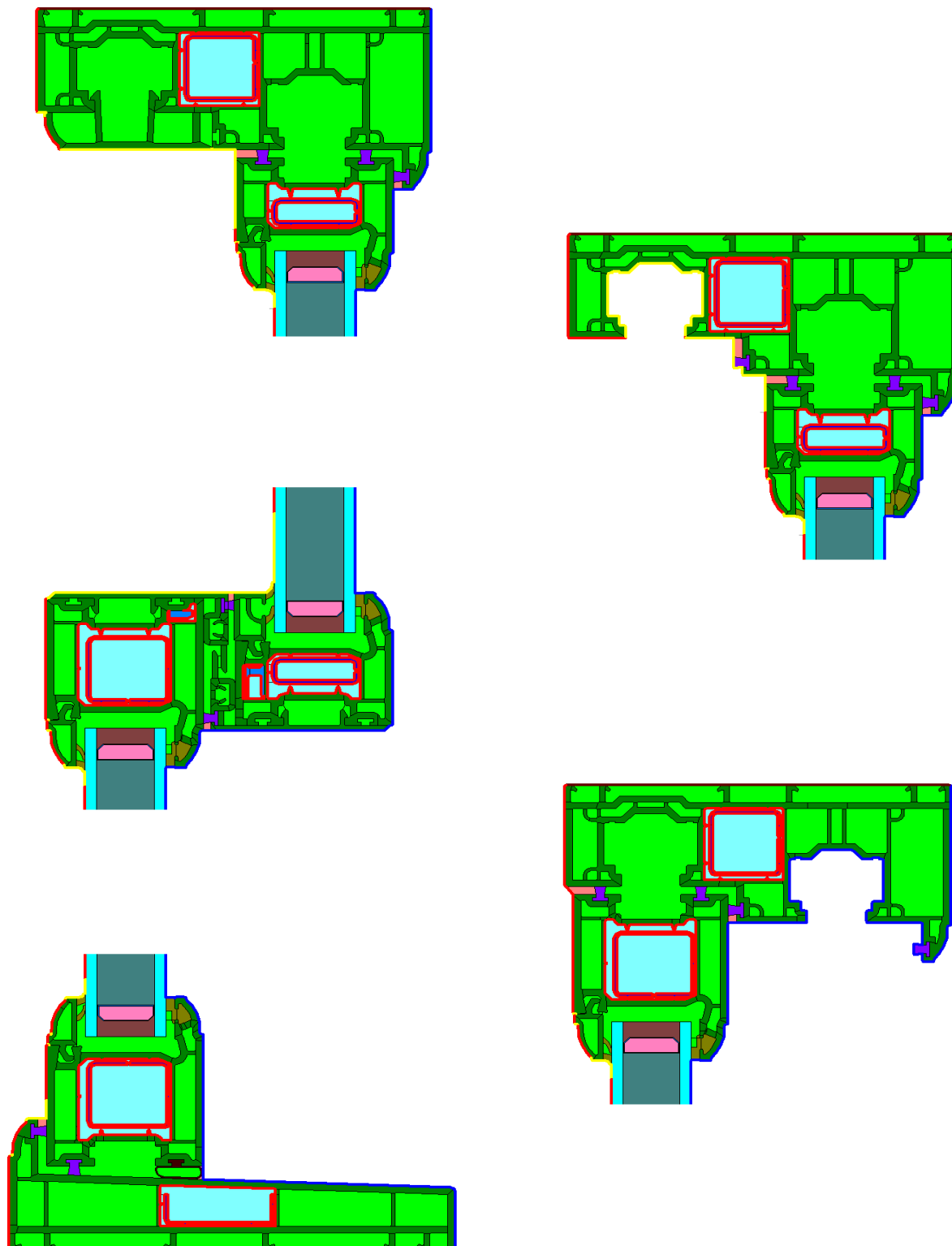
Manufacturer	Product	Inner	Gas Space		Outer	Ug	g
Saint-Gobain	Planitherm Total 1.3	En = 0.09	20mm Air	0.0437	Clear	1.577	0.66
			20mm Argon	0.0356	Low Iron	1.353	0.71

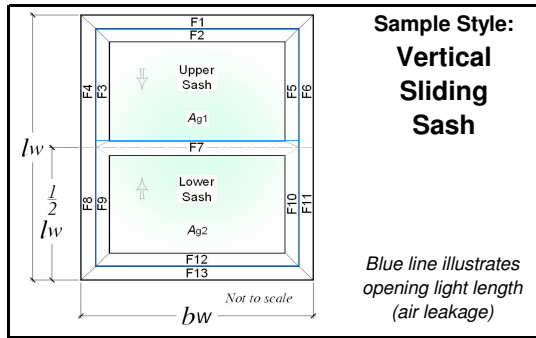
Manufacturer	Product	Inner	Gas Space		Outer	Ug	g
AGC Flatglass	Planibel A	En = 0.10	20mm Air	0.0448	Clear	1.604	0.73
			20mm Argon	0.0366	Low Iron	1.383	0.78

Manufacturer	Product	Inner	Gas Space		Outer	Ug	g
Guardian	Climaguard D	En = 0.12	20mm Air	0.0469	Clear	1.659	0.68
			20mm Argon	0.0387	Low Iron	1.444	0.72

Manufacturer	Product	Inner	Gas Space		Outer	Ug	g
AGC Flatglass	Planibel G	En = 0.15	20mm Air	0.0500	Clear	1.735	0.72
			20mm Argon	0.0419	Low Iron	1.529	0.77
Pilkington	K	En = 0.15	20mm Air	0.0500	Clear	1.735	0.72
			20mm Argon	0.0419	Low Iron	1.529	0.78
Pilkington	K OW	En = 0.15	20mm Air	0.0500	Clear	1.735	0.73
			20mm Argon	0.0419	Low Iron	1.529	0.79

Therm Simulation Models





Report Number: MVS C -16 1.6

Report Issue No.11 (03/03/09)

Report Date: 03 August 2010

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Project Details:

**VEKA - Matrix Vertical Sliding Window**

**Input Values:**

Yellow input, green intermediary, blue finals

X' DP is no. of decimal place to enter

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

**Upper Panel Glazing dim's and properties:**

Thickness of pane 1	4	mm
Pane 1/2 distance	20	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)	Argon 90%	
Thickness of pane 3		mm
Glazing Trans. - <b>3DP</b>	$U_g$ 1.221	W/(m <sup>2</sup> ·K)
g-value - <b>2DP</b>	$g_{\perp}$ 0.71	0.05

**Thermal transmittance of window from hot box test**

$U_{w-2DP}$		W/(m <sup>2</sup> ·K)
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**Window Dimensions:**

Section	Length		Area	
	(m)	(m)	No gasket (m <sup>2</sup> )	With gasket (m <sup>2</sup> )
Upper glazing	0.6010	1.0180	0.6118	0.6044
Lower glazing	0.6110	1.0180	0.6220	0.6171
Total of glazing			1.2338	1.2216
Frame	(m)	(m <sup>2</sup> )	(m <sup>2</sup> )	(m <sup>2</sup> )
F1	1.2300	0.0530	0.0624	0.0624
F2	1.1240	0.0530	0.0568	0.0583
F3	0.6870	0.0530	0.0341	0.0350
F4	0.7400	0.0530	0.0378	0.0378
F5	0.6870	0.0530	0.0341	0.0350
F6	0.7400	0.0530	0.0378	0.0378
F7	1.1240	0.0660	0.0711	0.0767
F8	0.7400	0.0390	0.0279	0.0279
F9	0.6900	0.0670	0.0436	0.0445
F10	0.6900	0.0670	0.0436	0.0445
F11	0.7400	0.0390	0.0279	0.0279
F12	1.1520	0.0460	0.0499	0.0514
F13	1.2300	0.0500	0.0596	0.0596
Total Frame			0.5866	0.5988
Total Window, $A_w$			1.8204	1.8204
Percentage upper glass area			33.61%	33.20%
Percentage lower glass area			34.17%	33.90%
Percentage glass area (total)			67.78%	67.10%

**Solar Factor, g-value:**

$F_w$	0.9
$g_w$	0.43

$U_{window}$   $U_w$  1.60 W/(m<sup>2</sup>·K)

Other parameters needed for calculation, taken from simulations:

Upper glazing: Panel thickness,  $d_p = d_g = 0.028$  m

$\lambda_p = 0.035$  W/(m·K)  $R_{se} = 0.04$  m<sup>2</sup>·K/W  $R_{se} = 0.13$  m<sup>2</sup>·K/W

$R_p = 0.8000$  m<sup>2</sup>·K/W  $R_{tot} = 0.9700$  m<sup>2</sup>·K/W  $U_p = 1.0309$  W/(m<sup>2</sup>·K)

**Frame dimensions:**

	(b <sub>f</sub> )	Without gasket (mm)	Gasket protrusion (mm)	With gasket (mm)	Total
All frame values to nearest 0.5mm, gaskets to <b>1DP</b>	F1 fixed top rail	53	n/a	53	107.5
	F2 moving top rail	53	1.5	54.5	
F3 top (LH) jamb (moving sash)		53	1.5	54.5	107.5
F4 top (LH) jamb (fixed frame)		53	n/a	53	
F5 top (RH) jamb (moving sash)		53	1.5	54.5	107.5
F6 top (RH) jamb (fixed frame)		53	n/a	53	
F7 mid rail	(upper gasket)	66	4.0	71.5	71.5
	(lower gasket)		1.5		
F8 bottom (LH) jamb (fixed frame)		39	n/a	39	107.5
F9 bottom (LH) jamb (moving sash)		67	1.5	68.5	
F10 bottom (RH) jamb (moving sash)		67	1.5	68.5	107.5
F11 bottom (RH) jamb (fixed frame)		39	n/a	39	
F12 bottom moving rail		46	1.5	47.5	97.5
F13 bottom fixed rail		50	n/a	50	
Total gasket area		0.0122635		m <sup>2</sup>	

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

**Frame conductance:**

Section	All L values to <b>4DP</b> . All b values to <b>ODP</b>			
	$W/(m \cdot K)$	$b_p$ (mm)	$L_f^{2D}$	$L_{\psi}^{2D}$
F1+F2 top rail	0.3484	200		0.4637
F3+F4 top (LH) jamb	0.3596	200		0.4764
F5+F6 top (RH) jamb	0.3596	200		0.4764
F7 mid rail	0.5493	400		0.7721
F8+F9 bottom (LH) jamb	0.3668	200		0.4846
F10+F11 bottom (RH) jamb	0.3668	200		0.4846
F12+F13 bottom rail	0.3551	200		0.4718

**Frame:**

Section	$b_f$ (no gaskets) (m)	$U_f$ (W/(m <sup>2</sup> ·K))	Frame areas (no gaskets) (m <sup>2</sup> )	Heat flow (W/K)	$\psi$ (W/(m·K))	$l_g$ (m)	Heat flow (W/K)
F1+F2 top rail	0.1060	1.3416	0.1191	0.1598	0.0773	1.0180	0.0787
F3+F4 top left jamb	0.1060	1.4473	0.0719	0.1041	0.0788	0.6010	0.0474
F5+F6 top right jamb	0.1060	1.4473	0.0719	0.1041	0.0788	0.6010	0.0474
F7 mid rail	0.0660	2.0747	0.0711	0.1476	0.1468	1.0180	0.1494
F8+F9 btm left jamb	0.1060	1.5152	0.0715	0.1083	0.0798	0.6110	0.0487
F10+F11 btm right jamb	0.1060	1.5152	0.0715	0.1083	0.0798	0.6110	0.0487
F12+F13 bottom rail	0.0960	1.5512	0.1095	0.1698	0.0787	1.0180	0.0801
Totals				0.5866	0.9021	Total 0.5004	

**Air Leakage loss:**

Air leakage at 50 Pa per hour & per unit length of opening light (BS 6375-1) - <b>2DP</b>	0.20	m <sup>3</sup> /(m·h)
Opening light length	6.1540	m
Total air leakage	1.231	m <sup>3</sup> /h
$L_{50}$	0.68	m <sup>3</sup> /(m <sup>2</sup> ·h)
Heat loss = 0.0165 $L_{50}$	0.01	W/(m <sup>2</sup> ·K)

BFRC Rating kWh/(m <sup>2</sup> ·yr)	Label index	EWER Rating Scale	Window Rating
≥ 0	<b>-16</b>	A	<b>C</b>
-10 to <0		B	
-20 to <-10 ←		C ←	
-30 to <-20		D	
-50 to <-30		E	
-70 to <-50		F	
<-70		G	

**BFRC Rating =**

218.6g window - 68.5 x ( $U_{window}$ + Effective $L_{50}$ ) =	<b>-16.29</b>
Climate zone is:	<b>UK</b>

Thermal transmittance, W/(m <sup>2</sup> ·K)	$U_{window}$	<b>1.6</b>
Solar factor	$g_{window}$	<b>0.43</b>
Window air leakage heat loss, W/(m <sup>2</sup> ·K)	$L_{factor}$	<b>0.01</b>

Simulator Name: T.J. Williams - VEKA plc



BFRC Certified Simulator 009