

THERMAL SIMULATION REPORT

Report Number:	TCL2014-SWA-007
Prepared For:	Steel Window Association 42 Heath Street Tamworth Staffordshire B79 7HJ
Window System Identifier:	W20
Fixed Outer Frame Identifier:	W8
Transom Frame Identifier:	N/A
Vent Frame Identifier:	W5
Glazing System:	4mm Planilux – 8 mm 90% Krypton – 4 mm Planitherm One or Planitherm 4S
Spacer Bar:	8mm Edgetech Super Spacer Standard with Butyl secondary sealant.
Notes:	Aluminium glazing bead. Reference drawing SWA-W20-007

Results

Thermal Transmittance (U_{window})	2.0	W/(m ² K)
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(Window Configuration as defined in BS EN 14351-1 Annex E)
(1230mm wide x 1480mm high – single pane vent)

Report Prepared By Dr Gary Morgan
 Therm Consulting

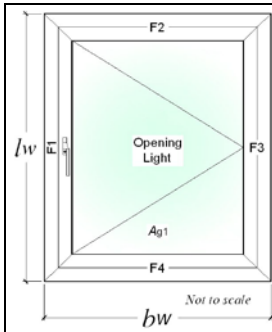
Signed: *G. Morgan*

Date: 29th April 2014

The simulations in this report were performed using Win IsoPro 7.80
strictly according to EN ISO 10077 – 2:2012
The files generated are attached to this report as appendices



**BFRC Certified
Simulator 016**



Window Style:
L2
Side Hung
Casement

Report Number: **TCL2014-SWA 007** Report Issue Status: 02 (04/2008)
 Report Date: **29th April 2014**
 Project Details: **W20 Frame 4 mm Float 8mm 90% Krypton 4 mm Planitherm 4S or Planitherm One Super Spacer Standard**

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

Parameter	Symbol	Units
Total window height ODP	l_w	1480 mm
Total window width ODP	b_w	1230 mm

Glazing dimensions and properties:
 Nominal 4mm etc to **ODP**, others **1DP**

Thickness of pane 1	4	mm
Pane 1/2 distance	8	mm
Krypton Gas fill (1/2)	90	%
Thickness of pane 2	4	mm
No further entry required for double glazed units		
Pane 2/3 distance (n/a for DG)		mm
Gas fill (2/3)		%
Thickness of pane 3 (n/a for DG)		mm
Thermal transmittance of glazing - 3DP		
U_g	1.114	W/(m ² ·K)

Frame dimensions:

	(b _f)	No gasket (mm)	Gasket protrusion (mm)	With gasket (mm)
All frame values to nearest 0.5mm, gaskets to 1DP	F1 LH jamb	55.5	0.7	56.2
	F2 head	55.5	0.7	56.2
	F3 RH jamb	55.5	0.7	56.2
	F4 sill	55.5	0.7	56.2
Total gasket area				0.0035 m ²

Window Dimensions:

Section	Length (mm)	Width (mm)	Area	
			No gasket (m ²)	With gasket (m ²)
Window	1369	1119	1.5319	1.5284
Total glazing, A_g			1.5319	1.5284

All L values to **4DP**. All b values to **ODP**

	W/(m·K)	b _p (mm)	W/(m·K)	b _g (mm)
F1 LH jamb	0.6470	190	0.6020	190
F2 head	0.6470	190	0.6020	190
F3 RH jamb	0.6470	190	0.6020	190
F4 sill	0.6470	190	0.6020	190

Frame	(mm)	(mm)	(m ²)	(m ²)
F1	1480	55.5	0.0791	0.0800
F2	1230	55.5	0.0652	0.0660
F3	1480	55.5	0.0791	0.0800
F4	1230	55.5	0.0652	0.0660
Total Frame			0.2885	0.2920
Total Window, A_w			1.8204	1.8204
Percentage glass area			84.15%	83.96%

Frame:

Section	b _f (with gaskets) (m)	U _f (W/(m ² ·K))	Frame areas (with gaskets) (m ²)	Heat flow (W/K)	ψ (W/(m·K))	l _g (m)	Heat flow (W/K)
F1 LH jamb	0.0562	6.1217	0.0800	0.4898	0.0460	1.3676	0.0629
F2 head	0.0562	6.1217	0.0660	0.4038	0.0460	1.1176	0.0514
F3 RH jamb	0.0562	6.1217	0.0800	0.4898	0.0460	1.3676	0.0629
F4 sill	0.0562	6.1217	0.0660	0.4038	0.0460	1.1176	0.0514
Totals				0.2920	1.7873	Total	0.2286

Other parameters needed for calculation, taken from simulations:
 Panel thickness, $d_p = d_g = 0.016$ m $U_p = 1.5945$ W/(m²·K)
 $\lambda_p = 0.035$ W/(m·K) $R_{se} = 0.04$ m²·K/V $R_{tot} = 0.6271$ m²·K/W $R_p = 0.4571$ m²·K/W $R_{si} = 0.13$ m²·K/W

U_{window}	$U_w =$	2.04	W/(m ² ·K)
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Thermal transmittance, W/(m ² ·K)	U_{window}	2.0
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Simulator Name: **Dr Gary Morgan**



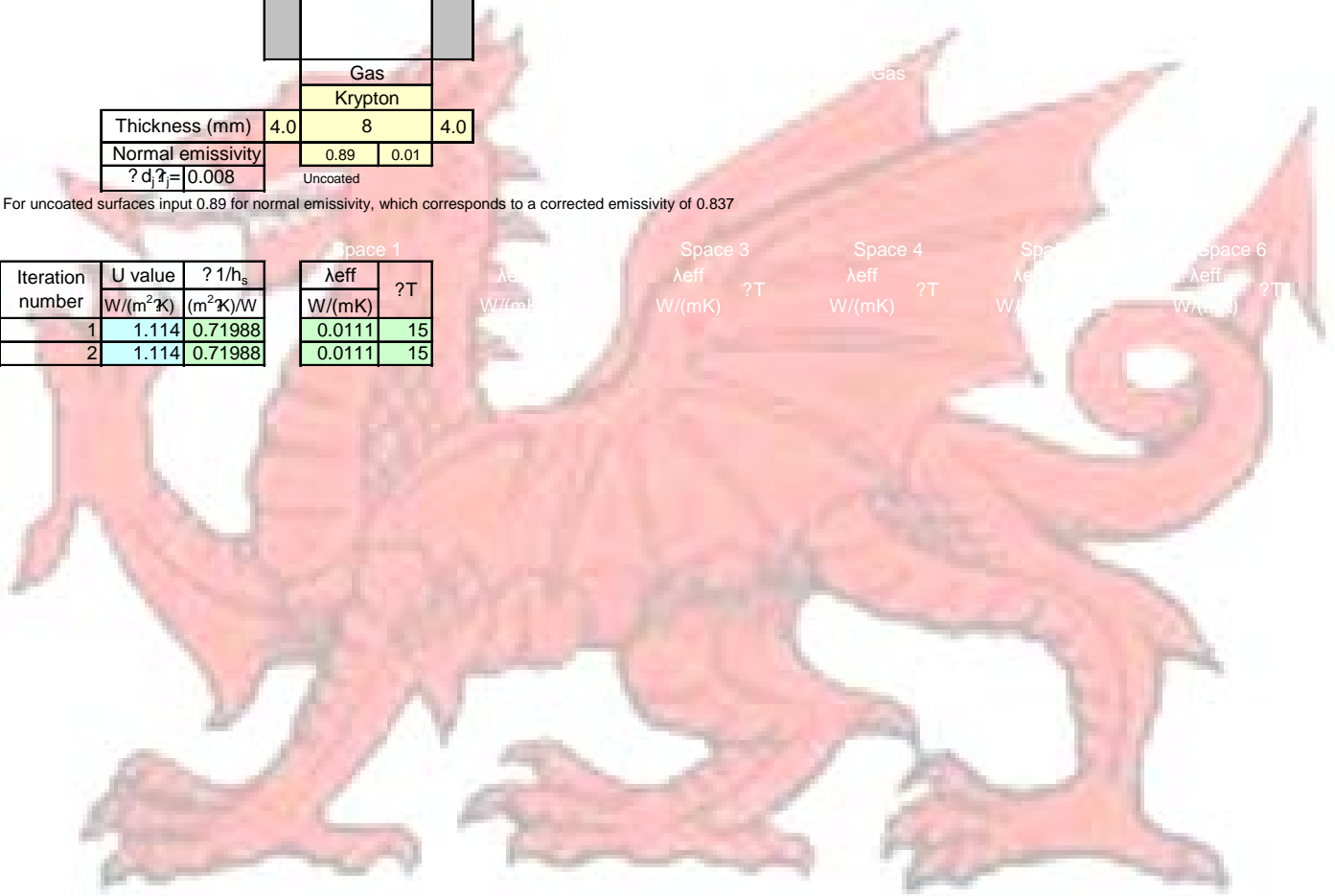
BFRC Certified
 Simulator **016**

Number of spaces
1

Glazing orientation		Vertical	
Resistivity panes	1	m-K/W	
Outside			
Pane 1		90%	
Pane 2			
Gas			
Krypton			
Thickness (mm)	4.0	8	4.0
Normal emissivity	0.89	0.01	
$\epsilon_{d, \epsilon} = 0.008$	Uncoated		

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

Iteration number	U value W/(m ² K)	ϵ / h_s (m ² K)/W	Space 1		Space 3		Space 4		Space 5		Space 6	
			λ_{eff} W/(mK)	ϵT	λ_{eff} W/(mK)	ϵT	λ_{eff} W/(mK)	ϵT	λ_{eff} W/(mK)	ϵT		
1	1.114	0.71988	0.0111	15								
2	1.114	0.71988	0.0111	15								



Simulation software: WinIso2D 7.80

Date: 29.04.2014

File: C:\Users\Gary\Documents\MyDocs from Thermbridge\Thermal Simulation Output Files\Steel Window Association\May 2014\W20 - Thermal Simulations\W20 Commercial Aluminium Bead\W20 Commercial Aluminium Bead.f2d

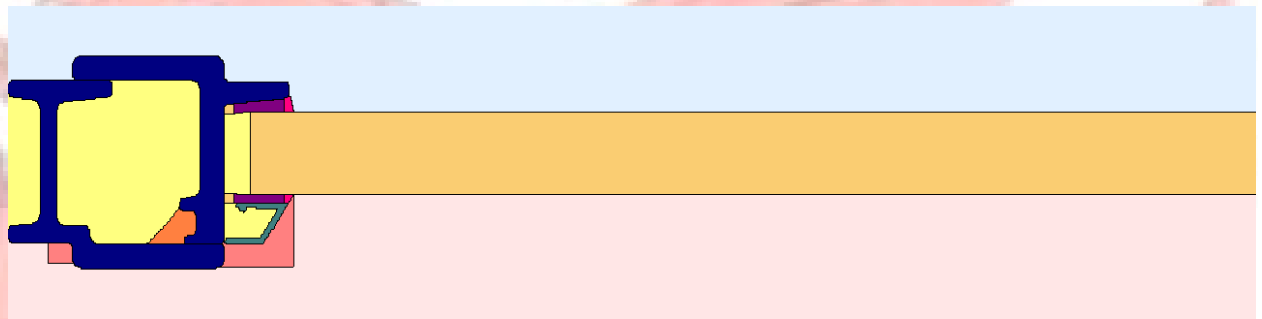


Calculation of the thermal transmission coefficient U_f according to EN ISO 10077-2:2003-12

Simulation model:

Dimensions (width x height): 245,20 x 61,69 mm

Number of elements in simulation model: X-direction: 230; Y-direction: 107



Boundary conditions:

External:

Temperature Θ_e : 0,00 °C
Surface resistance R_{se} : 0,040 m²K/W

Internal:

Temperature Θ_i : 20,00 °C
Surface resistance R_{si} 1: 0,130 m²K/W
Surface resistance R_{si} 2: 0,200 m²K/W

Results:

Temperature difference ΔT : 20,00 K
Total heat flow Q : 12,937 W/m
2D thermal conductance L_{2D} : 0,647 W/mK

Length 1: 190,00 mm
U-value 1: 1,595 W/m²K

Length 2: 0,00 mm
U-value 2: 0,000 W/m²K

U_f -value: 6,139 W/m²K

Materials:

Material	R (m ² K/W)	T (°C)	Q(gesamt) (W/m)	10077 konform
****ADIABAT****	0,000	0,000	0,000	
1 boundary condition inside 0,13, 20°C, 50%	0,130	20,000	9,826	X
1 boundary condition outside 0,04, 0°C, 80%	0,040	0,000	-12,041	X
1 boundary condition inside 0,20, 20°C, 50%	0,200	20,000	2,215	X
1 air EN ISO 10077-2 (cavities in profiles)				X
1 air EN ISO 10077-2 (cavities in profiles <=2mm)				X
1 air EN ISO 10077-2 (cavities in profiles, sparse ventilated)				X
Material	L (W/mK)	Emiss		10077 konform
3 alu (Si-Leg.) 160	160,000	0,900		X
3 structural steel 50 (2)	50,000	0,900		X
3 structural steel 50	50,000	0,900		X
2 Float Glass 1.0	1,000	0,837		X
5 PVC soft	0,140	0,900		X
5 Elastomeric Foam Flexible	0,050	0,900		X
6 Silicon, unfilled	0,350	0,900		X
6 Super Spacer Standard	0,130	0,900		-
6 butyle	0,240	0,900		X
SZR L=0.0111	0,011	0,900		-

Simulation software: WinIso2D 7.80

Date: 29.04.2014

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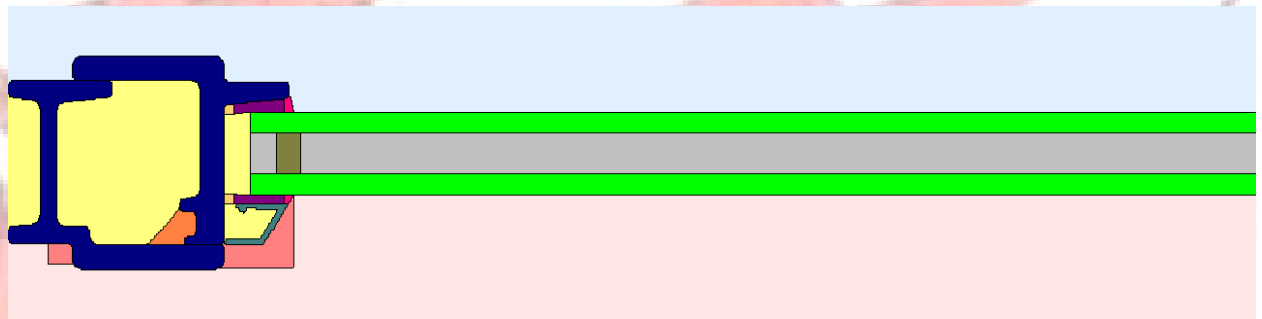


Calculation of the linear thermal transmission coefficient Ψ according to EN ISO 10077-2

Simulation model:

Dimensions (width x height): 245,20 x 61,69 mm

Number of elements in simulation model: X-direction: 230; Y-direction: 107



Boundary conditions:

External:

Temperature Θ_e : 0,00 °C

Surface resistance R_{se} : 0,040 m²K/W

Internal:

Temperature Θ_i : 20,00 °C

Surface resistance R_{si} 1: 0,130 m²K/W

Surface resistance R_{si} 2: 0,200 m²K/W

Results:

Temperature difference dT : 20,00 K

Total heat flow Q : 12,041 W/m

2D thermal conductance L_{2D} : 0,602 W/mK

Length top/left: 190,00 mm

U-value top/left: 1,114 W/m²K

Length bottom/right: 0,00 mm

U-value bottom/right: 0,000 W/m²K

Ψ -value: 0,047 W/mK

Materials:

Material	R (m ² K/W)	T (°C)	Q(gesamt) (W/m)	10077 konform
****ADIABAT****	0,000	0,000	0,000	
1 boundary condition inside 0,13, 20°C, 50%	0,130	20,000	9,826	X
1 boundary condition outside 0,04, 0°C, 80%	0,040	0,000	-12,041	X
1 boundary condition inside 0,20, 20°C, 50%	0,200	20,000	2,215	X
1 air EN ISO 10077-2 (cavities in profiles)				X
1 air EN ISO 10077-2 (cavities in profiles <=2mm)				X
1 air EN ISO 10077-2 (cavities in profiles, sparse ventilated)				X
Material	L (W/mK)	Emiss		10077 konform
3 alu (Si-Leg.) 160	160,000	0,900		X
3 structural steel 50 (2)	50,000	0,900		X
3 structural steel 50	50,000	0,900		X
2 Float Glass 1.0	1,000	0,837		X
5 PVC soft	0,140	0,900		X
5 Elastomeric Foam Flexible	0,050	0,900		X
6 Silicon, unfilled	0,350	0,900		X
6 Super Spacer Standard	0,130	0,900		-
6 butyle	0,240	0,900		X
SZR L=0.0111	0,011	0,900		-