THERMAL SIMULATION REPORT

Report Number:	**GM2010-09**
Prepared For:	**Steel Window Association 42 Heath Street Tamworth Staffordshire B79 7HJ**
Window System Identifier:	**W30**
Fixed Outer Frame Identifier:	**WX7 (Fixed)**
Transom Frame Identifier:	**N/A**
Vent Frame Identifier:	**WX7 (Moving)**
Glazing System:	**4mm Planilux – 10 mm 90% Krypton – 4 mm Planitherm One**
Spacer Bar:	**10mm Edgetech Tri Seal with PIB Primary and 4mm Butyl Secondary sealants**
Notes:	

Results

Thermal Transmittance (U_{window})	**1.7**	*W/(m^2K)*

(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

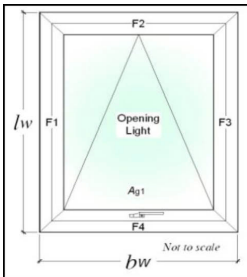
Signed: *G Morgan*

Date: *2nd September 2010*

The simulations in this report were performed using Therm 5.2.14 according to EN ISO 10077 – 2.
The Therm files generated are attached to this report as appendices

British Fenestration Rating Council

BFRC Certified Simulator 016



Window Style:
L2
Top Hung Casement

Report Number: GM2010-009 Rev 1
Report Date: 2nd September 2010
Project Details: 4-10-4 Optiwhite 90% Krypton Planitherm Onne Plus Edgetech Tri Seal Spacer Butyl Secondary Sealant

Report Issue Status: 02 *(04/2008)*

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

Parameter	*Symbol*		*Units*
Total window height ***0DP***	l_w	1480	mm
Total window width ***0DP***	b_w	1230	mm

Glazing dimensions and properties:
Nominal 4mm etc to ***0DP***, others ***1DP***

Thickness of pane 1	**4**	mm
Pane 1/2 distance	**10**	mm
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	**0.966**	W/(m²·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	**51**	**2**	53
	F2 head	**51**	**2**	53
	F3 RH jamb	**51**	**2**	53
	F4 sill	**51**	**2**	53
	Total gasket area		0.01	m²

Window Dimensions:

Section	Length (mm)	Width (mm)	Area No gasket (m²)	Area With gasket (m²)
Window	1378	1128	1.5544	1.5444
Total glazing, A_g			1.5544	1.5444

All L values to ***4DP***. All b values to ***0DP***		W/(m·K)	b_p (mm)		W/(m·K)	b_g (mm)
F1 LH jamb	$L_f{}^{2D}$	**0.5301**	**190**	$L_\psi{}^{2D}$	**0.4862**	190
F2 head		**0.5301**	190		**0.4862**	190
F3 RH jamb		**0.5301**	190		**0.4862**	190
F4 sill		**0.5301**	190		**0.4862**	190

Frame	(mm)	(mm)	(m²)	(m²)
F1	1480	51	0.0729	0.0756
F2	1230	51	0.0601	0.0624
F3	1480	51	0.0729	0.0756
F4	1230	51	0.0601	0.0624
Total Frame			0.2660	0.2760
Total Window, A_w			1.8204	1.8204
Percentage glass area			85.39%	84.84%

Frame:

Section	b_f (with gaskets) (m)	U_f W/(m²·K)	Frame areas (with gaskets) m²	Heat flow W/K	ψ W/(m·K)	l_g (m)	Heat flow W/K
F1 LH jamb	0.0530	4.7630	0.0756	0.3602	0.0500	1.3740	0.0687
F2 head	0.0530	4.7630	0.0624	0.2971	0.0500	1.1240	0.0562
F3 RH jamb	0.0530	4.7630	0.0756	0.3602	0.0500	1.3740	0.0687
F4 sill	0.0530	4.7630	0.0624	0.2971	0.0500	1.1240	0.0562
		Totals	0.2760	1.3147		Total	0.2498

Other parameters needed for calculation, taken from simulations: Panel thickness, $d_p = d_g$ = 0.018 m — U_p = 1.4614 W/(m²·K)
λ_p = 0.035 W/(m·K) — R_{se} = 0.04 m²·K/W — R_{tot} = 0.6843 m²·K/W — R_p = 0.5143 m²·K/W — R_{si} = 0.13 m²·K/W

U_{window}	U_w =	**1.68**	W/(m²·K)
Thermal transmittance, W/(m²·K)	U_{window}	**1.7**	

British Fenestration Rating Council

BFRC Certified Simulator **016**

Simulator Name: Dr Gary Morgan

Version 9 July 2010. Calculations according to BS EN 673:1998 (A1)

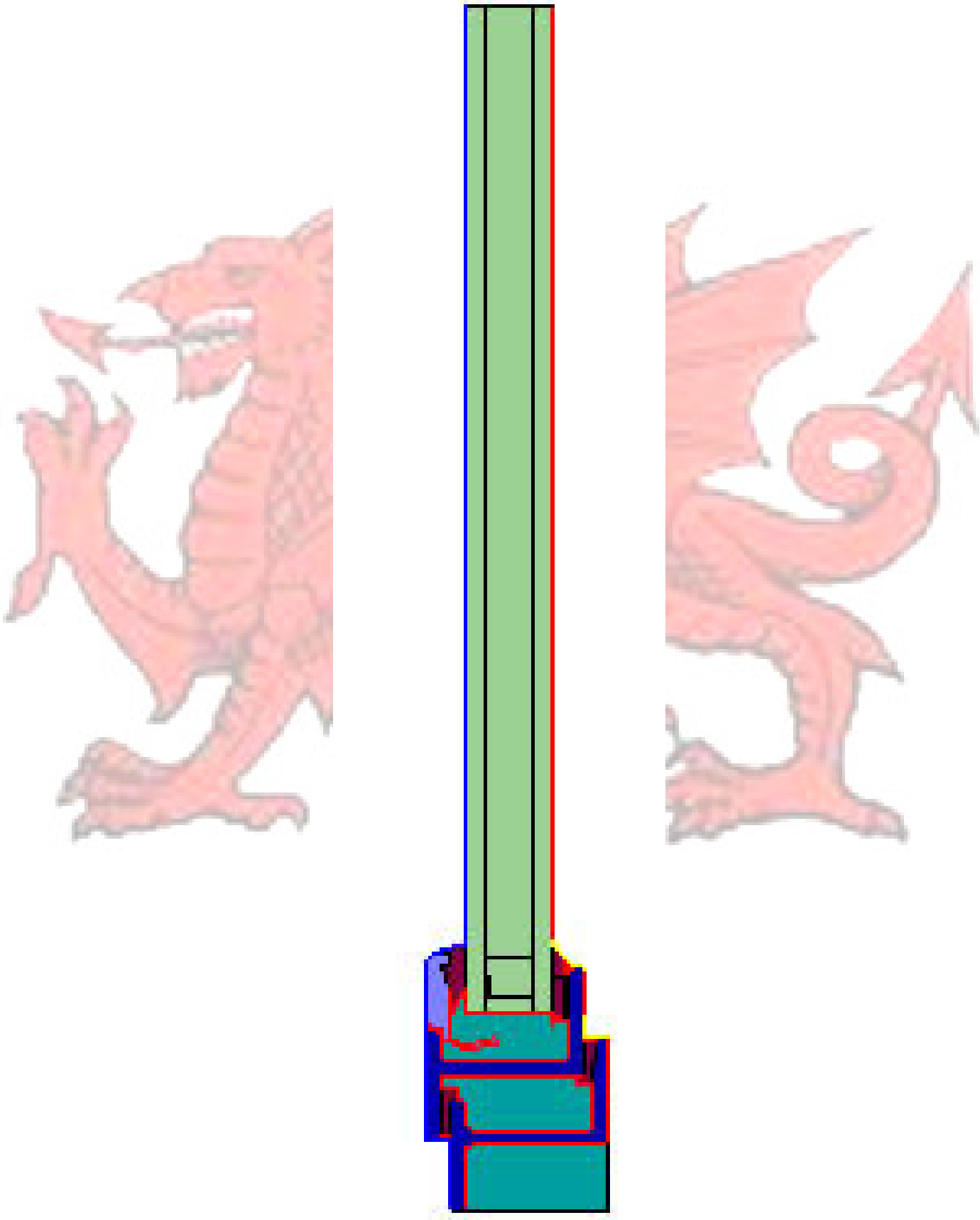
Number of spaces
1

Spaces 1

Glazing orientation	Vertical		Pane 1	90%	Pane 2
Resistivity panes	1	m·K/W			
Outside				Gas	
				Krypton	
Thickness (mm)			4.0	10	4.0
Normal emissivity				0.89 0.01	
$\sum d_j \cdot r_j$=	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	$\sum 1/h_s$	λeff	ΔT
	W/(m²·K)	(m²·K)/W	W/(mK)	
1	0.966	0.8592	0.0116	15
2	0.966	0.8592	0.0116	15



Therm Version 5.2 (5.2.14)
Date: Fri Sep 03 13:58:34 2010

Created by:
Created for:

Therm Filename: D:\MyDocs from Thermbridge\Therm Output Files\Steel Window Association\September 2010\W30\For Report\opener_panel Garys.THM
Cross Section Type: Sill
Underlay Name:

U-factors

Name	Length mm	Basis	U-factor W/m2-K
Linear Transmittance	1000.00	Custom	0.5301

Solid Materials

Name	Conductivity W/m-K	Emissivity
CEN Insulation Panel	0.04	0.90
CEN EPDM	0.25	0.90
CEN PVC Foam Elastomer	0.05	0.90
CEN Aluminium Si Alloys	160.00	0.90
CEN Steel	50.00	0.90

Cavities

Name: CEN Cavity (Unventilated) - Detailed
Gas Fill: Air
Convection Model: CEN
Radiation Model: Advanced

Poly ID	Heat Flow Dir	Side 1 Temp C	Side 1 Emis	Side 2 Temp C	Side 2 Emis	Dimension Horz. mm	Dimension Vert. mm	Nu #	Keff W/m-K	Cavity Height mm
26	Horizontal	7.00	0.90	-4.00	0.90	1.16	1.66	N/A	0.0250	N/A
140	Horizontal	7.00	0.90	-4.00	0.90	0.52	0.41	N/A	0.0250	N/A
203	Horizontal	7.00	0.90	-4.00	0.90	28.30	13.22	N/A	0.0459	N/A
55	Horizontal	7.00	0.90	-4.00	0.90	28.36	10.28	N/A	0.0460	N/A
31	Horizontal	15.00	0.90	5.00	0.90	0.61	3.64	N/A	0.0250	N/A
33	Horizontal	15.00	0.90	5.00	0.90	0.71	1.15	N/A	0.0250	N/A
34	Horizontal	15.00	0.90	5.00	0.90	19.50	10.67	N/A	0.0307	N/A

Name: CEN Cavity (Slightly Ventilated) - Detailed
Gas Fill: Air
Convection Model: CEN Ventilated
Radiation Model: Advanced

Poly ID	Heat Flow Dir	Side 1 Temp C	Side 1 Emis	Side 2 Temp C	Side 2 Emis	Dimension Horz. mm	Dimension Vert. mm	Nu #	Keff W/m-K	Cavity Height mm
139	Horizontal	7.00	0.90	-4.00	0.90	0.79	1.58	N/A	0.0500	N/A
8	Horizontal	7.00	0.90	-4.00	0.90	2.59	0.87	N/A	0.0500	N/A
7	Horizontal	7.00	0.90	-4.00	0.90	2.60	0.87	N/A	0.0500	N/A

Glazing Systems

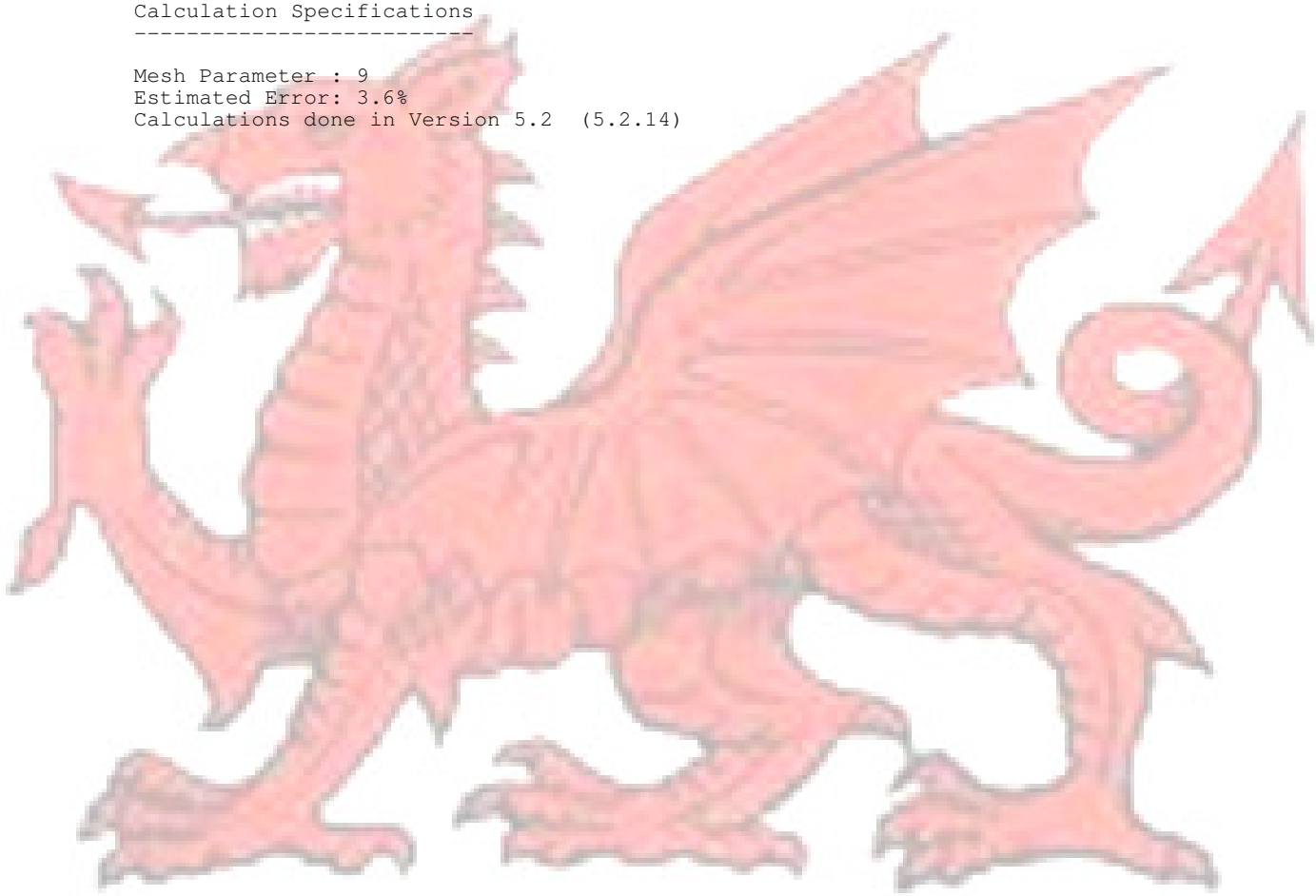
None

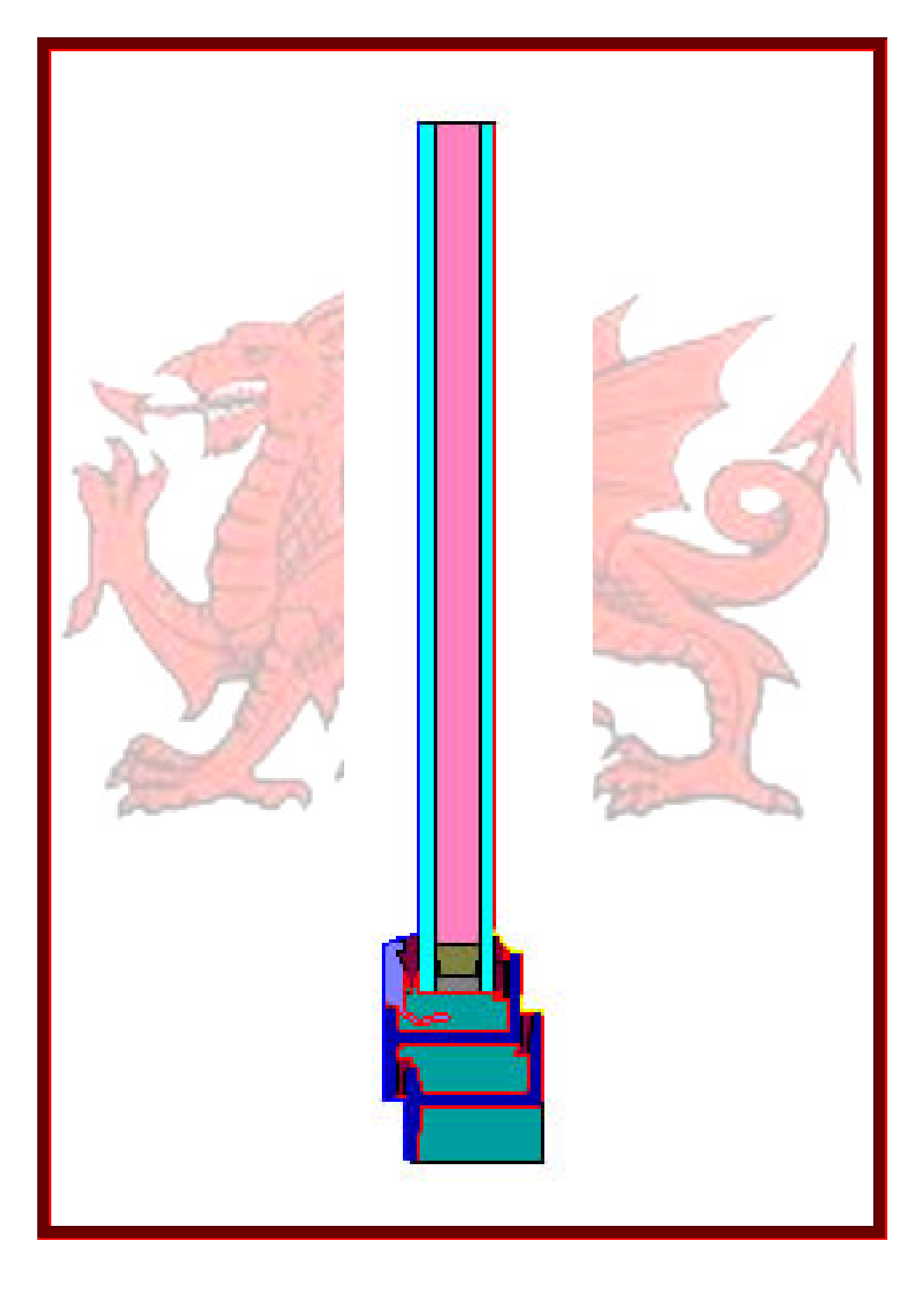
Standard Boundary Conditions

Name	Temperature C	Film Coefficient W/m2-K
CEN Exterior	0.00	25.000
CEN Interior	20.00	7.692
CEN Red Rad	20.00	5.000

Calculation Specifications

Mesh Parameter : 9
Estimated Error: 3.6%
Calculations done in Version 5.2 (5.2.14)





Therm Version 5.2 (5.2.14)
Date: Fri Sep 03 13:59:45 2010

Created by:
Created for:

Therm Filename: D:\MyDocs from Thermbridge\Therm Output Files\Steel Window Association\September 2010\W30\For Report\opener_glass Garys Planithrm One.THM
Cross Section Type: Sill
Underlay Name:

U-factors

Name	Length mm	Basis	U-factor W/m2-K
Linear Transmittance	1000.00	Custom	0.4862

Solid Materials

Name	Conductivity W/m-K	Emissivity
CEN Edgetech Tri Seal	0.13	0.90
CEN Polyisobutylene	0.20	0.90
CEN Butyl Solid / Hot Melt	0.24	0.90
CEN Glass	1.00	0.90
4 10 4 Planitherm One 90% Kryp ton	0.01	0.90
CEN EPDM	0.25	0.90
CEN PVC Foam Elastomer	0.05	0.90
CEN Aluminium Si Alloys	160.00	0.90
CEN Steel	50.00	0.90

Cavities

Name: CEN Cavity (Unventilated) - Detailed
Gas Fill: Air
Convection Model: CEN
Radiation Model: Advanced

Poly ID	Heat Flow Dir	Side 1 Temp C	Side 1 Emis	Side 2 Temp C	Side 2 Emis	Dimension Horz. mm	Dimension Vert. mm	Nu #	Keff W/m-K	Cavity Height mm
26	Horizontal	7.00	0.90	-4.00	0.90	1.16	1.66	N/A	0.0250	N/A
140	Horizontal	7.00	0.90	-4.00	0.90	0.52	0.41	N/A	0.0250	N/A
203	Horizontal	7.00	0.90	-4.00	0.90	28.30	13.22	N/A	0.0459	N/A
55	Horizontal	7.00	0.90	-4.00	0.90	28.36	10.28	N/A	0.0460	N/A
31	Horizontal	15.00	0.90	5.00	0.90	0.61	3.64	N/A	0.0250	N/A
33	Horizontal	15.00	0.90	5.00	0.90	0.71	1.15	N/A	0.0250	N/A
34	Horizontal	15.00	0.90	5.00	0.90	19.50	10.67	N/A	0.0307	N/A

Name: CEN Cavity (Slightly Ventilated) - Detailed
Gas Fill: Air
Convection Model: CEN Ventilated
Radiation Model: Advanced

Poly ID	Heat Flow Dir	Side 1 Temp C	Side 1 Emis	Side 2 Temp C	Side 2 Emis	Dimension Horz. mm	Dimension Vert. mm	Nu #	Keff W/m-K	Cavity Height mm
139	Horizontal	7.00	0.90	-4.00	0.90	0.79	1.58	N/A	0.0500	N/A
8	Horizontal	7.00	0.90	-4.00	0.90	2.59	0.87	N/A	0.0500	N/A

7	Horizontal	7.00	0.90	-4.00	0.90	2.60	0.87	N/A

0.0500 N/A

Glazing Systems

None

Standard Boundary Conditions

Name	Temperature C	Film Coefficient W/m2-K
CEN Exterior	0.00	25.000
CEN Interior	20.00	7.692
CEN Red Rad	20.00	5.000

Calculation Specifications

Mesh Parameter : 9
Estimated Error: 4.2%
Calculations done in Version 5.2 (5.2.14)