THERMAL SIMULATION REPORT

Report Number:	**TCL2014-SWA-013**
Prepared For:	**Steel Window Association 42 Heath Street Tamworth Staffordshire B79 7HJ**
Door System Identifier:	**W40**
Lock Panel Frame Identifier	**SWZ7**
Meeting Rail Identifier:	**SW5/SWX8**
Vent Frame Identifier:	**SW5**
Outer Frame Identifier:	**SW8**
Glazing System:	**4mm Planitherm One/4S – 8mm 90% Krypton – 4mm Planilux -8 mm 90% Krypton – 4mm Planitherm One/4S**
Spacer Bar:	**8mm Edgetech Super Spacer Standard with butyl secondary sealant**
Notes:	**Stainless Steel Bead Reference Drawing SWA-W40-012**

Result

Thermal Transmittance (U_{Door})	**1.5**	*W/(m²K)*

(Door Configuration as defined in BS EN 14351-1 Annex E)
(2000mm wide x 2180 high – dual leaf)

Report Prepared By *Dr Gary Morgan*
Therm Consulting

Signed: *G Morgan*

Date: *21st May 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

British Fenestration Rating Council
BFRC Certified Simulator 016

GENERAL WINDOW / DOOR U VALUE

Frame Elements

Frame Element (Name)	Area (mm2)	Area (m2)	Uframe	Sight Line Length (mm)	Sight Line Length (m)	Psi value	Area x Uf	Lengthx Psi	Total Heat Flow
Left Head	51813.086	0.051813	6.048	911.5	0.9115	0.0510	0.313366	0.0464865	0.359852047
Right Head	51408.084	0.051408	6.048	911.5	0.9115	0.0510	0.310916	0.0464865	0.35740259
Left Jamb	114804.23	0.114804	6.048	2072.0007	2.0720007	0.0510	0.694336	0.10567204	0.800008031
Right Jamb	114804.18	0.114804	6.048	2072.0007	2.0720007	0.0510	0.694336	0.10567204	0.80000771
Meeting Rail	146693.67	0.146694	6.309	1962	1.962	0.0960	0.92549	0.188352	1.113842336
Left Sill	51813.086	0.051813	6.048	911.5	0.9115	0.0510	0.313366	0.0464865	0.359852047
Right Sill	51408.084	0.051408	6.048	911.5	0.9115	0.0510	0.310916	0.0464865	0.35740259
Lock Panel Frame	20520.149	0.02052	6.368	546	0.546	0.0480	0.130672	0.026208	0.156880306
		0			0		0	0	0
		0			0		0	0	0
		0			0		0	0	0
		0			0		0	0	0
		0			0		0	0	0
		0			0		0	0	0
		0			0		0	0	0
		0			0		0	0	0
		0			0		0	0	0
		0			0		0	0	0
		0			0		0	0	0

Note, when dealing with Transom or Mullion sections, take the average of both sight line dimensions.

Totals		0.603265							4.305247656

Glazing

Glazing Pane	Area (mm2)	Area (m2)	Uglass				Area x Ug		Total Heat Flow
Left Glass	1852768.6	1.852769	0.602				1.115367		1.115366696
Right Glass	1888628.7	1.888629	0.602				1.136954		1.136954488
Lock Panel	15339.919	0.01534	0.709				0.010876		0.010876003
		0					0		0
		0					0		0
		0					0		0
		0					0		0
		0					0		0

Totals		3.756737							2.263197187

Overall Window / Door Dimensions	
Height (mm)	2180
Width (mm)	2000

Total Window / Door Area m2 =	4.36	Total Window / Door Area Calculated =	4.360002	% Error	-0.00004128

Note - Both areas should match to better than 1%, if not, check figures carefully

Window / Door U value = 1.51

Version 11 23/10/2012. Calculations according to BS EN 673:2011

Number of spaces	Help
2	

			Spaces	1		2	
Glazing orientation			Pane 1	90%	Pane 2	90%	Pane 3
	Vertical						
Resistivity panes	1	m·K/W					
Outside							
Emissivities							
Calculate							
				Gas		Gas	
				Krypton		Krypton	
	Thickness (mm)		4.0	8	4.0	8	44
	Normal emissivity			0.01	0.89	0.89	0.01
	$\sum d_j \cdot r_j$=	0.052			Uncoated	Uncoated	

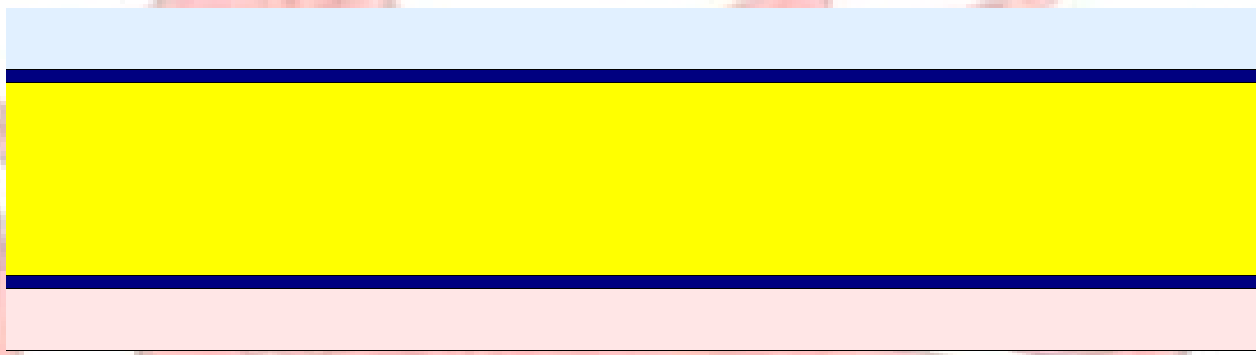
For uncoated surfaces input 0.89 for normal emissivity, which corresponds to a corrected emissivity of 0.837

Iteration number	U value	$\sum 1/h_s$	λeff	ΔT	λeff	ΔT
	W/(m²·K)	(m²·K)/W	W/(mK)		W/(mK)	
1	0.602	1.4398	0.0111	7.5	0.0111	7.5
2	0.602	1.4398	0.0111	7.5	0.0111	7.5

Simulation software: WinIso2D 7.80
Date: 21.05.2014
File: C:\Users\Gary\Documents\MyDocs from Thermbridge\Thermal Simulation Output Files\Steel Window Association\May 2014\W40 - SIMULATIONS Doors and Windows\W40-012\Lock Panel.f2d

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

Dimensions (width x height): 200,00 x 54,99 mm
Number of elements in simulation model: X-direction: 100; Y-direction: 28



Boundary conditions:

External:

Temperature Θe:	0,00	°C
Surface resistance Rse:	0,040	m²K/W

Internal:

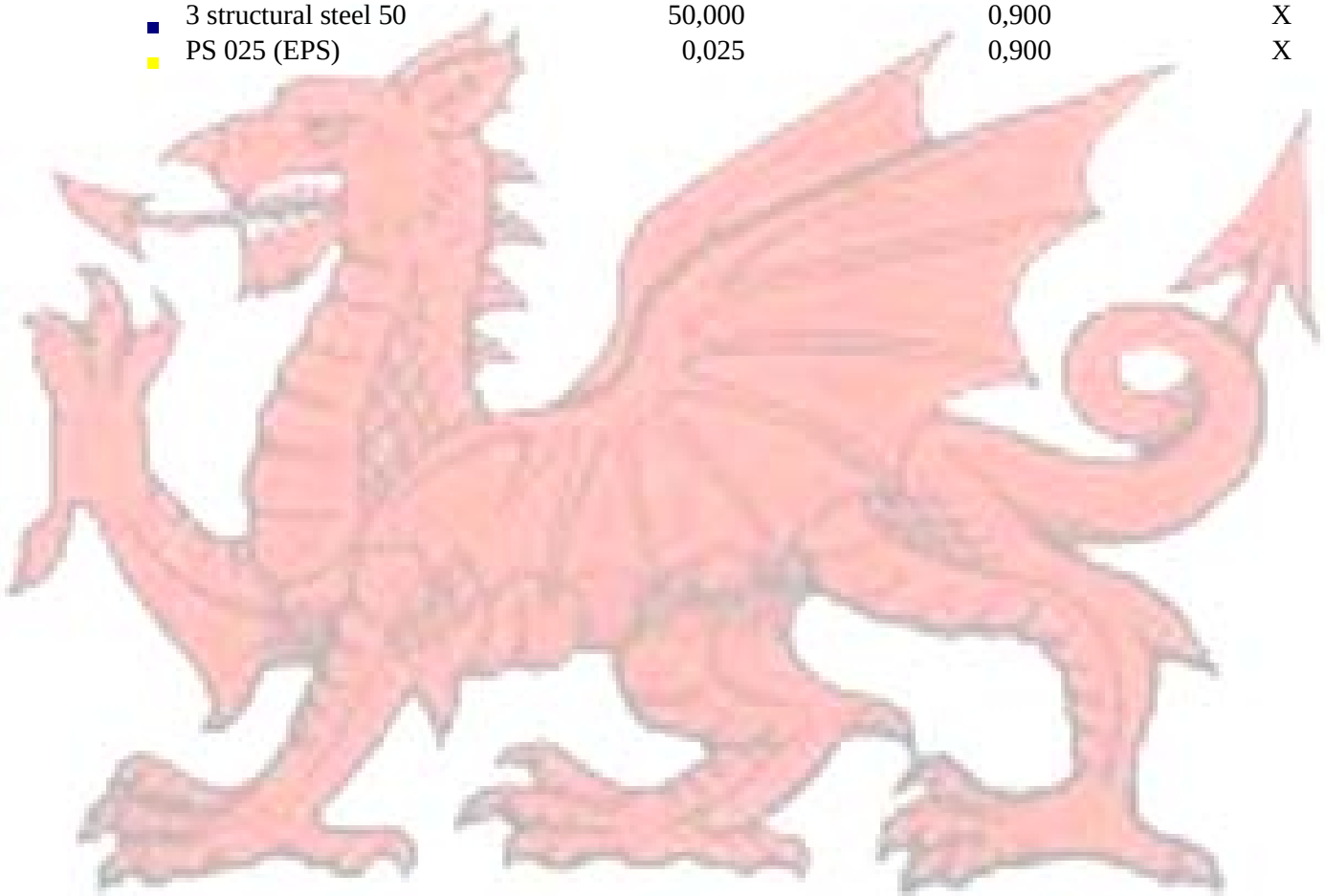
Temperature Θi:	20,00	°C
Surface resistance Rsi 1:	0,130	m²K/W
Surface resistance Rsi 2:		m²K/W

Results:

Temperature difference dT:	20,00	K
Total heat flow Q:	2,838	W/m
2D thermal conductance L2D:	0,142	W/mK
Length top/left:	200,00	mm
U-value top/left:	0,709	W/m²K
Length bottom/right:	0,00	mm
U-value bottom/right:	0,000	W/m²K

Materials:

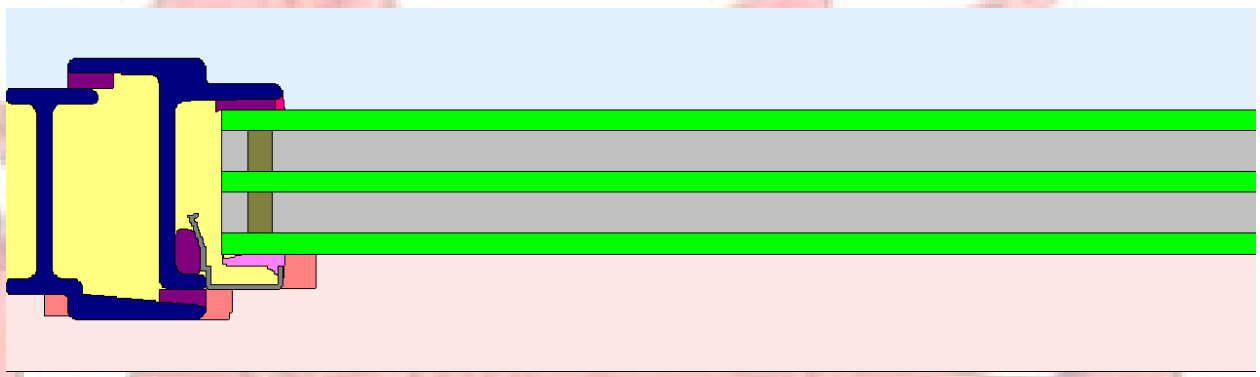
Material	R (m²K/W)	T (°C)	Q(gesamt) (W/m)	10077 konform
****ADIABAT****	0,000	0,000	0,000	
1 boundary condition outside 0,04, 0°C, 80%	0,040	0,000	-2,838	X
1 boundary condition intside 0,13, 20°C, 50%	0,130	20,000	2,838	X
Material	**L (W/mK)**	**Emiss**		**10077 konform**
3 structural steel 50	50,000	0,900		X
PS 025 (EPS)	0,025	0,900		X



Simulation software: WinIso2D 7.80
Date: 21.05.2014
File: C:\Users\Gary\Documents\MyDocs from Thermbridge\Thermal Simulation Output Files\Steel Window Association\May 2014\W40 - SIMULATIONS Doors and Windows\W40-012\Section 1.f2d

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

Dimensions (width x height): 243,99 x 70,90 mm
Number of elements in simulation model: X-direction: 207; Y-direction: 133



Boundary conditions:

External:

Temperature Θe:	0,00	°C
Surface resistance Rse:	0,040	m²K/W

Internal:

Temperature Θi:	20,00	°C
Surface resistance Rsi 1:	0,130	m²K/W
Surface resistance Rsi 2:	0,200	m²K/W

Results:

Temperature difference dT:		20,00	K
Total heat flow Q:		9,842	W/m
2D thermal conductance L2D:	0,492	W/mK	
Length top/left:	190,00	mm	
U-value top/left:		0,602	W/m²K
Length bottom/right:		0,00	mm
U-value bottom/right:		0,000	W/m²K
Ψ-value:		0,051	W/mK

Materials:

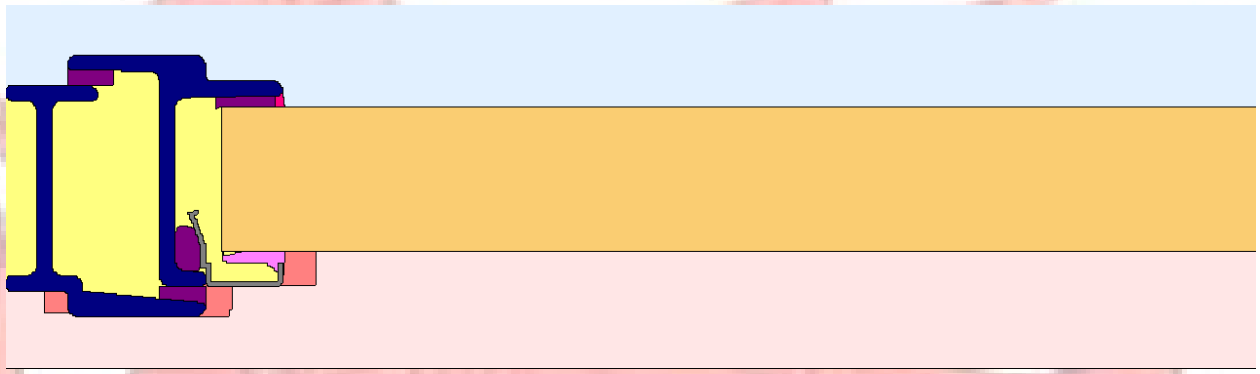
Material	R (m²K/W)	T (°C)	Q(gesamt) (W/m)	10077 konform
****ADIABAT****	0,000	0,000	0,000	
1 boundary condition outside 0,04, 0°C, 80%	0,040	0,000	-9,842	X
1 boundary condition intside 0,13, 20°C, 50%	0,130	20,000	7,673	X
1 boundary condition intside 0,20, 20°C, 50%	0,200	20,000	2,168	X
1 air EN ISO 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 structural steel 50	50,000	0,900	X
PS 025 (EPS)	0,025	0,900	-
2 Float Glass 1.0	1,000	0,837	X
3 stainless steel 17	17,000	0,900	X
5 PVC soft	0,140	0,900	X
6 Silicon, unfilled	0,350	0,900	X
5 Elastomeric Foam Flexible	0,050	0,900	X
6 Super Spacer Standard	0,130	0,900	X
6 butyle	0,240	0,900	X
SZR L=0.0108	0,011	0,900	-

Simulation software: WinIso2D 7.80
Date: 21.05.2014
File: C:\Users\Gary\Documents\MyDocs from Thermbridge\Thermal Simulation Output Files\Steel Window Association\May 2014\W40 - SIMULATIONS Doors and Windows\W40-012\Section 1.f2d

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

Dimensions (width x height): 243,99 x 70,90 mm
Number of elements in simulation model: X-direction: 207; Y-direction: 133



Boundary conditions:

External:

Temperature Θe:	0,00	°C
Surface resistance Rse:	0,040	m²K/W

Internal:

Temperature Θi:	20,00	°C
Surface resistance Rsi 1:	0,130	m²K/W
Surface resistance Rsi 2:	0,200	m²K/W

Results:

Temperature difference dT:	20,00	K
Total heat flow Q:	10,450	W/m
2D thermal conductance L2D:	0,523	W/mK
Length 1:	190,00	mm
U-value 1:	1,031	W/m²K
Length 2:	0,00	mm
U-value 2:	0,000	W/m²K
U_f-value:	6,048	W/m²K

Materials:

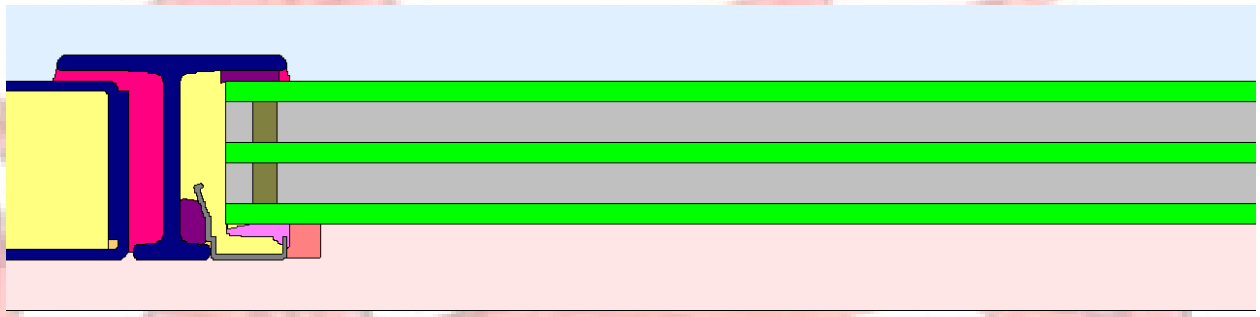
Material	R (m²K/W)	T (°C)	Q(gesamt) (W/m)	10077 konform
****ADIABAT****	0,000	0,000	0,000	
1 boundary condition outside 0,04, 0°C, 80%	0,040	0,000	-9,842	X
1 boundary condition intside 0,13, 20°C, 50%	0,130	20,000	7,673	X
1 boundary condition intside 0,20, 20°C, 50%	0,200	20,000	2,168	X
1 air EN ISO 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 structural steel 50	50,000	0,900	X
PS 025 (EPS)	0,025	0,900	-
2 Float Glass 1.0	1,000	0,837	X
3 stainless steel 17	17,000	0,900	X
5 PVC soft	0,140	0,900	X
6 Silicon, unfilled	0,350	0,900	X
5 Elastomeric Foam Flexible	0,050	0,900	X
6 Super Spacer Standard	0,130	0,900	X
6 butyle	0,240	0,900	X
SZR L=0.0108	0,011	0,900	-

Simulation software: WinIso2D 7.80
Date: 21.05.2014
File: C:\Users\Gary\Documents\MyDocs from Thermbridge\Thermal Simulation Output Files\Steel Window Association\May 2014\W40 - SIMULATIONS Doors and Windows\W40-012\Section 2.f2d

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

Dimensions (width x height): 245,09 x 60,00 mm
Number of elements in simulation model: X-direction: 200; Y-direction: 93



Boundary conditions:

External:

Temperature Θe:	0,00	°C
Surface resistance Rse:	0,040	m²K/W

Internal:

Temperature Θi:	20,00	°C
Surface resistance Rsi 1:	0,130	m²K/W
Surface resistance Rsi 2:	0,200	m²K/W

Results:

Temperature difference dT:		20,00	K
Total heat flow Q:		10,244	W/m
2D thermal conductance L2D:	0,512	W/mK	
Length top/left:	190,00	mm	
U-value top/left:		0,602	W/m²K
Length bottom/right:		0,00	mm
U-value bottom/right:		0,000	W/m²K
Ψ-value:		0,048	W/mK

Materials:

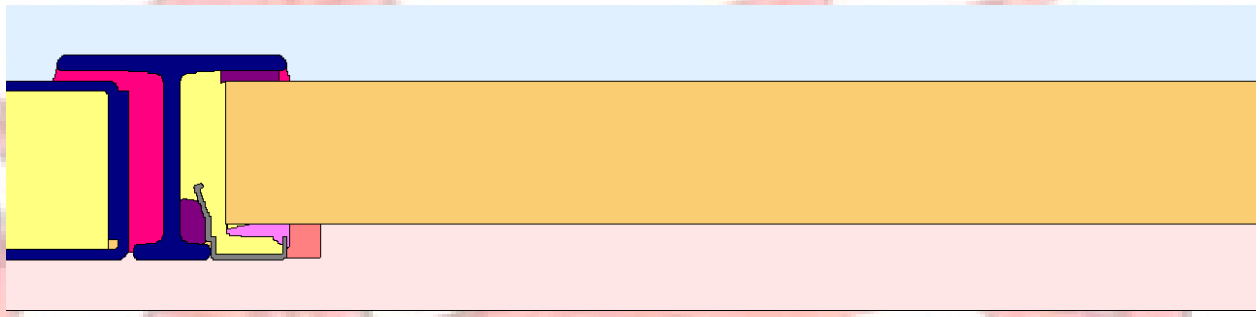
Material	R (m²K/W)	T (°C)	Q(gesamt) (W/m)	10077 konform
****ADIABAT****	0,000	0,000	0,000	
1 boundary condition outside 0,04, 0°C, 80%	0,040	0,000	-10,244	X
1 boundary condition intside 0,13, 20°C, 50%	0,130	20,000	9,561	X
1 boundary condition intside 0,20, 20°C, 50%	0,200	20,000	0,682	X
1 air EN ISO 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 structural steel 50	50,000	0,900	X
PS 025 (EPS)	0,025	0,900	-
2 Float Glass 1.0	1,000	0,837	X
3 stainless steel 17	17,000	0,900	X
5 PVC soft	0,140	0,900	X
6 Silicon, unfilled	0,350	0,900	X
5 Elastomeric Foam Flexible	0,050	0,900	X
6 Super Spacer Standard	0,130	0,900	X
6 butyle	0,240	0,900	X
SZR L=0.0108	0,011	0,900	-

Simulation software: WinIso2D 7.80
Date: 21.05.2014
File: C:\Users\Gary\Documents\MyDocs from Thermbridge\Thermal Simulation Output Files\Steel Window Association\May 2014\W40 - SIMULATIONS Doors and Windows\W40-012\Section 2.f2d

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

Dimensions (width x height): 245,09 x 60,00 mm
Number of elements in simulation model: X-direction: 200; Y-direction: 93



Boundary conditions:

External:

Temperature Θe:	0,00	°C
Surface resistance Rse:	0,040	m²K/W

Internal:

Temperature Θi:	20,00	°C
Surface resistance Rsi 1:	0,130	m²K/W
Surface resistance Rsi 2:	0,200	m²K/W

Results:

Temperature difference dT:	20,00	K
Total heat flow Q:	10,923	W/m
2D thermal conductance L2D:	0,546	W/mK
Length 1:	190,00	mm
U-value 1:	1,031	W/m²K
Length 2:	0,00	mm
U-value 2:	0,000	W/m²K
U_f-value:	6,368	W/m²K

Materials:

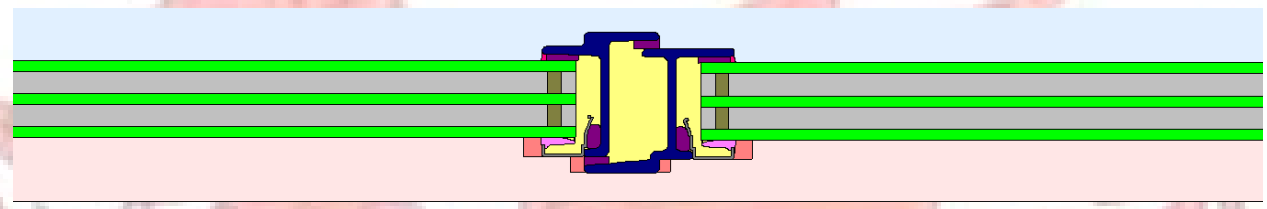
Material	R (m²K/W)	T (°C)	Q(gesamt) (W/m)	10077 konform
****ADIABAT****	0,000	0,000	0,000	
1 boundary condition outside 0,04, 0°C, 80%	0,040	0,000	-10,244	X
1 boundary condition intside 0,13, 20°C, 50%	0,130	20,000	9,561	X
1 boundary condition intside 0,20, 20°C, 50%	0,200	20,000	0,682	X
1 air EN ISO 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 structural steel 50	50,000	0,900	X
PS 025 (EPS)	0,025	0,900	-
2 Float Glass 1.0	1,000	0,837	X
3 stainless steel 17	17,000	0,900	X
5 PVC soft	0,140	0,900	X
6 Silicon, unfilled	0,350	0,900	X
5 Elastomeric Foam Flexible	0,050	0,900	X
6 Super Spacer Standard	0,130	0,900	X
6 butyle	0,240	0,900	X
SZR L=0.0108	0,011	0,900	-

Simulation software: WinIso2D 7.80
Date: 21.05.2014
File: C:\Users\Gary\Documents\MyDocs from Thermbridge\Thermal Simulation Output Files\Steel Window Association\May 2014\W40 - SIMULATIONS Doors and Windows\W40-012\Section 4.f2d

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

Dimensions (width x height): 448,98 x 69,99 mm
Number of elements in simulation model: X-direction: 339; Y-direction: 150



Boundary conditions:

External:

Temperature Θe:	0,00	°C
Surface resistance Rse:	0,040	m²K/W

Internal:

Temperature Θi:	20,00	°C
Surface resistance Rsi 1:	0,130	m²K/W
Surface resistance Rsi 2:	0,200	m²K/W

Results:

Temperature difference dT:	20,00	K
Total heat flow Q:	15,202	W/m
2D thermal conductance L2D:	0,760	W/mK
Length top/left:	190,00	mm
U-value top/left:	0,602	W/m²K
Length bottom/right:	190,00	mm
U-value bottom/right:	0,602	W/m²K
Ψ-value:	0,096	W/mK

Materials:

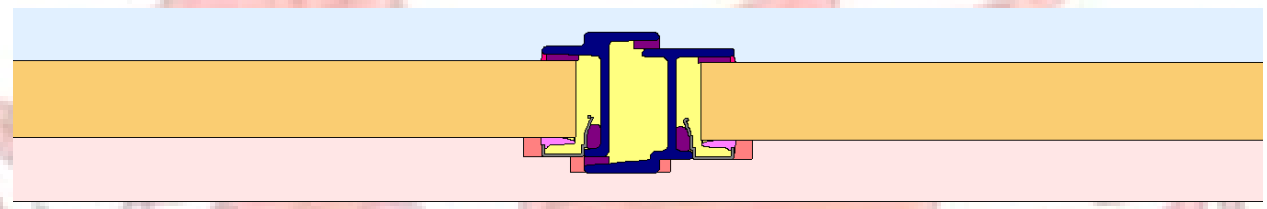
Material	R (m²K/W)	T (°C)	Q(gesamt) (W/m)	10077 konform
****ADIABAT****	0,000	0,000	0,000	
1 boundary condition outside 0,04, 0°C, 80%	0,040	0,000	-15,202	X
1 boundary condition intside 0,13, 20°C, 50%	0,130	20,000	12,429	X
1 boundary condition intside 0,20, 20°C, 50%	0,200	20,000	2,772	X
1 air EN ISO 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 structural steel 50	50,000	0,900	X
PS 025 (EPS)	0,025	0,900	-
2 Float Glass 1.0	1,000	0,837	X
3 stainless steel 17	17,000	0,900	X
5 PVC soft	0,140	0,900	X
6 Silicon, unfilled	0,350	0,900	X
5 Elastomeric Foam Flexible	0,050	0,900	X
6 Super Spacer Standard	0,130	0,900	X
6 butyle	0,240	0,900	X
SZR L=0.0108	0,011	0,900	-

Simulation software: WinIso2D 7.80
Date: 21.05.2014
File: C:\Users\Gary\Documents\MyDocs from Thermbridge\Thermal Simulation Output Files\Steel Window Association\May 2014\W40 - SIMULATIONS Doors and Windows\W40-012\Section 4.f2d

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

Dimensions (width x height): 448,98 x 69,99 mm
Number of elements in simulation model: X-direction: 339; Y-direction: 150



Boundary conditions:

External:

Temperature Θe:	0,00	°C
Surface resistance Rse:	0,040	m²K/W

Internal:

Temperature Θi:	20,00	°C
Surface resistance Rsi 1:	0,130	m²K/W
Surface resistance Rsi 2:	0,200	m²K/W

Results:

Temperature difference dT:	20,00	K
Total heat flow Q:	16,542	W/m
2D thermal conductance L2D:	0,827	W/mK
Length 1:	190,00	mm
U-value 1:	1,031	W/m²K
Length 2:	190,00	mm
U-value 2:	1,031	W/m²K
U_f-value:	6,309	W/m²K

Materials:

Material	R (m²K/W)	T (°C)	Q(gesamt) (W/m)	10077 konform
****ADIABAT****	0,000	0,000	0,000	
1 boundary condition outside 0,04, 0°C, 80%	0,040	0,000	-15,202	X
1 boundary condition intside 0,13, 20°C, 50%	0,130	20,000	12,429	X
1 boundary condition intside 0,20, 20°C, 50%	0,200	20,000	2,772	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 structural steel 50	50,000	0,900	X
PS 025 (EPS)	0,025	0,900	-
2 Float Glass 1.0	1,000	0,837	X
3 stainless steel 17	17,000	0,900	X
5 PVC soft	0,140	0,900	X
6 Silicon, unfilled	0,350	0,900	X
5 Elastomeric Foam Flexible	0,050	0,900	X
6 Super Spacer Standard	0,130	0,900	X
6 butyle	0,240	0,900	X
SZR L=0.0108	0,011	0,900	-