

THERMAL SIMULATION REPORT

Report Number:	TCL2014-SWA-025
Prepared For:	Steel Window Association 42 Heath Street Tamworth Staffordshire B79 7HJ
Door System Identifier:	W20
Lock Panel Frame Identifier	WT2
Meeting Rail Identifier:	W5 / W6
Vent Frame Identifier:	W5
Outer Frame Identifier:	W8
Glazing System:	4mm Optitherm S1Plus - 8mm 90% Krypton – 4mm KOW with coating reversed
Spacer Bar:	8mm Edgetech Super Spacer Standard with butyl secondary sealant
Notes:	Aluminium Bead Reference Drawing SWA-W20-013

Result

Thermal Transmittance (U_{Door})	1.8	W/(m ² K)
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(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: 

Date: 11th July 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**

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
Head	107358	0.107358	5.933	1834.4132	1.8344132	0.0600	0.636955	0.11006479	0.747019804
Left Jamb	117294.53	0.117295	5.933	2069.5956	2.0695956	0.0600	0.695908	0.12417574	0.820084178
Right Jamb	117294.53	0.117295	5.933	2069.5956	2.0695956	0.0600	0.695908	0.12417574	0.820084178
Mullion	114203.39	0.114203	6.402	2069.5956	2.0695956	0.1110	0.73113	0.22972511	0.960855207
Sill	107358	0.107358	5.933	1834.4132	1.8344132	0.0600	0.636955	0.11006479	0.747019804
Lock Frame	12295.975	0.012296	6.56	481	0.481	0.0550	0.080662	0.026455	0.107116596
		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
		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		0.575804							4.202179767
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Glazing

Glazing Pane	Area (mm2)	Area (m2)	Uglass	Area x Ug	Total Heat Flow
Lock Panel	15339.919	0.01534	0.918	0.014082	0.014082046
Left Glass	1870610.8	1.870611	1	1.870611	1.870610783
Right Glass	1898246.7	1.898247	1	1.898247	1.898246677
		0		0	0
		0		0	0
		0		0	0
		0		0	0
		0		0	0

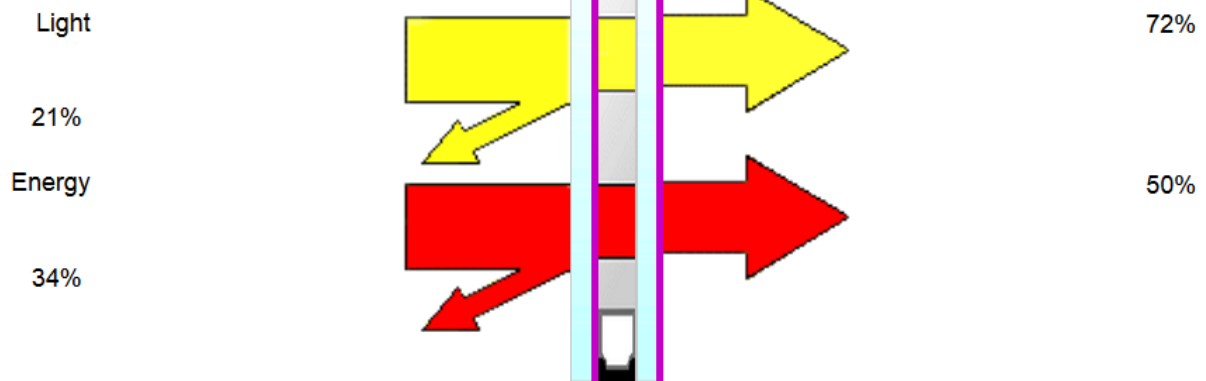
Totals		3.784197			3.782939505
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Overall Window / Door Dimensions	
Height (mm)	2180
Width (mm)	2000

Total Window / Door Area m2 =	4.36	Total Window / Door Area Calculated =	4.360002	% Error	-0.00004129
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Note - Both areas should match to better than 1%, if not, check figures carefully

Window / Door U value = 1.83



Description

Position	Product	Process	Thickness (nominal) mm	Weight kg/m ²
Glass 1	Pilkington Optitherm S1 Plus	Annealed	4	10
Cavity 1	Krypton (90%)		8	
Glass 2	Pilkington K Glass OW	Annealed	4	10
Product Code	-8Kr-K4w		16	20

Performance

Light				Sound Reduction		
Transmittance	LT	72%		R_w dB (C;C _{tr})	NPD	
	UV %	34%				
Reflectance Out	LR out	21%		Thermal Transmittance	W/m ² K	1.00
Reflectance In	LR in	20%				
Energy				Ra		
Direct Transmittance	ET	47%		98		
Reflectance	ER	34%		Performance Code		
Absorptance	EA	19%		U-value/Light/Energy		
Total Transmittance	g	50%		1.00 / 72 / 50		
Shading Coefficient Total		0.58				

Simulation software: WinIso2D 7.92

Date: 09.07.2014

File: C:\Users\Gary\Documents\MyDocs from Thermbridge\Thermal Simulation Output Files\Steel Window Association\July 2014\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 46,99 mm

Number of elements in simulation model: X-direction: 100; Y-direction: 24



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: m²K/W

Results:

Temperature difference dT : 20,00 K
Total heat flow Q : 3,671 W/m
2D thermal conductance L_{2D} : 0,184 W/mK
Length top/left: 200,00 mm
U-value top/left: 0,918 W/m²K
Length bottom/right: 0,00 mm
U-value bottom/right: 0,000 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 outside 0,04, 0°C, 80%	0,040	0,000	-3,671	X
1 boundary condition inside 0,13, 20°C, 50%	0,130	20,000	3,671	X
1 boundary condition inside 0,20, 20°C, 50%	0,200	20,000	0,000	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 7.92

Date: 11.07.2014

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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 64,69 mm

Number of elements in simulation model: X-direction: 198; Y-direction: 94



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 : 11,524 W/m

2D thermal conductance L_{2D} : 0,576 W/mK

Length top/left: 190,00 mm

U-value top/left: 1,000 W/m²K

Length bottom/right: 0,00 mm

U-value bottom/right: 0,000 W/m²K

Ψ -value: 0,060 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 outside 0,04, 0°C, 80%	0,040	0,000	-11,524	X
1 boundary condition inside 0,13, 20°C, 50%	0,130	20,000	8,675	X
1 boundary condition inside 0,20, 20°C, 50%	0,200	20,000	2,848	X
1 air EN ISO 10077-2 (cavities in profiles)				X
1 air EN ISO 10077-2 (cavities in profiles <=2mm)				X

Material	L (W/mK)	Emiss	10077 konform
3 structural steel 50	50,000	0,900	X
2 Float Glass 1.0	1,000	0,837	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
3 alu (Si-Leg.) 160	160,000	0,900	X
SZR L=0.0097	0,010	0,900	-

Simulation software: WinIso2D 7.92

Date: 11.07.2014

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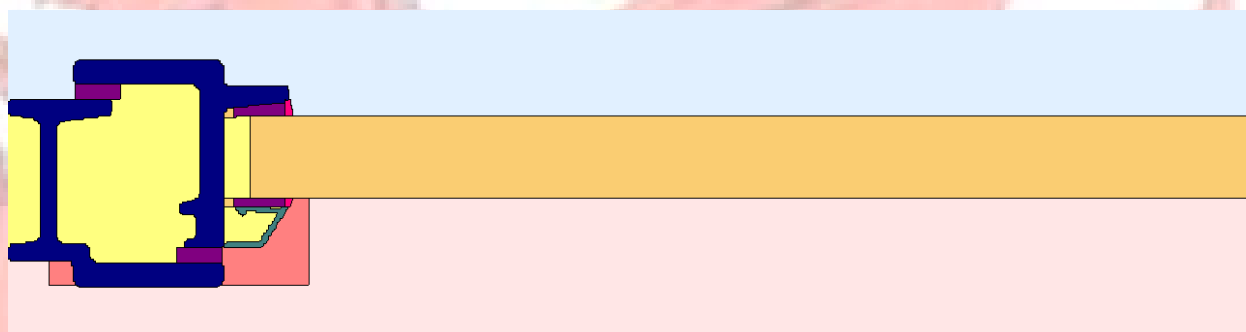


Calculation of the thermal transmission coefficient U_f according to EN ISO 10077-2:2003-12

Simulation model:

Dimensions (width x height): 245,20 x 64,69 mm

Number of elements in simulation model: X-direction: 198; Y-direction: 94



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 : 12,587 W/m

2D thermal conductance L_{2D} : 0,629 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: 5,933 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 outside 0,04, 0°C, 80%	0,040	0,000	-11,524	X
1 boundary condition inside 0,13, 20°C, 50%	0,130	20,000	8,675	X
1 boundary condition inside 0,20, 20°C, 50%	0,200	20,000	2,848	X
1 air EN ISO 10077-2 (cavities in profiles)				X
1 air EN ISO 10077-2 (cavities in profiles <=2mm)				X

Material	L (W/mK)	Emiss	10077 konform
3 structural steel 50	50,000	0,900	X
2 Float Glass 1.0	1,000	0,837	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
3 alu (Si-Leg.) 160	160,000	0,900	X
SZR L=0.0097	0,010	0,900	-

Simulation software: WinIso2D 7.92

Date: 11.07.2014

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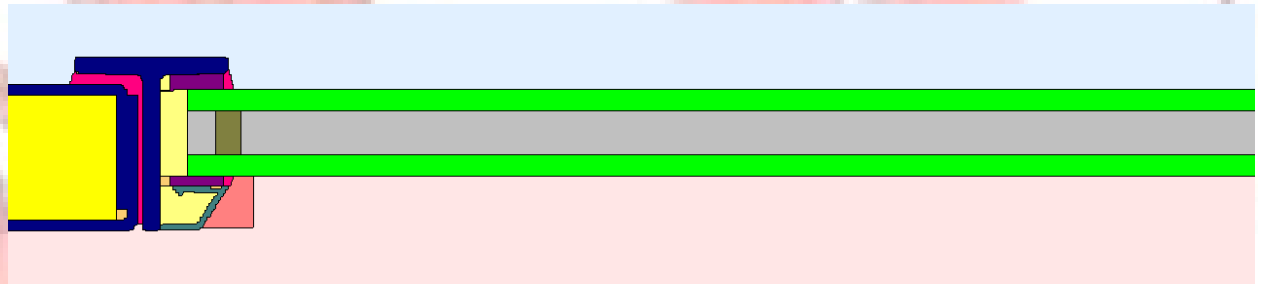


Calculation of the linear thermal transmission coefficient Ψ according to EN ISO 10077-2

Simulation model:

Dimensions (width x height): 230,85 x 51,99 mm

Number of elements in simulation model: X-direction: 165; Y-direction: 71



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 : 10,273 W/m
2D thermal conductance L_{2D} : 0,514 W/mK

Length top/left: 190,00 mm
U-value top/left: 1,000 W/m²K

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

Ψ -value: 0,055 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 outside 0,04, 0°C, 80%	0,040	0,000	-10,273	X
1 boundary condition inside 0,13, 20°C, 50%	0,130	20,000	9,186	X
1 boundary condition inside 0,20, 20°C, 50%	0,200	20,000	1,087	X
1 air EN ISO 10077-2 (cavities in profiles)				X
1 air EN ISO 10077-2 (cavities in profiles <=2mm)				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
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
3 alu (Si-Leg.) 160	160,000	0,900	X
SZR L=0.0097	0,010	0,900	-

Simulation software: WinIso2D 7.92

Date: 11.07.2014

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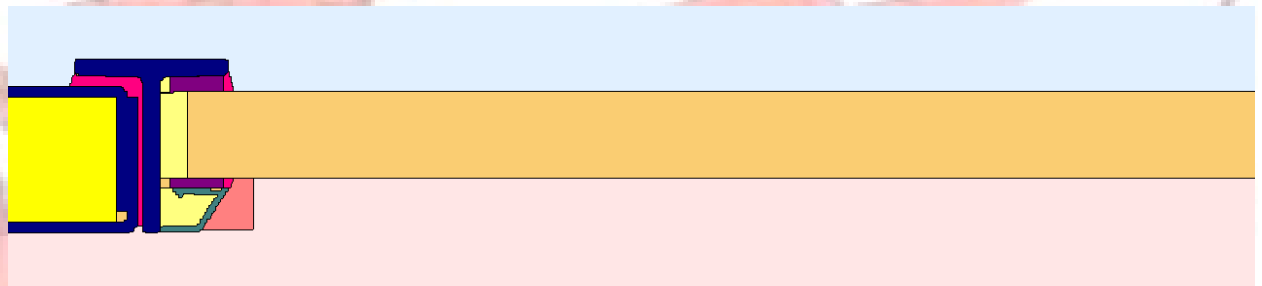


Calculation of the thermal transmission coefficient U_f according to EN ISO 10077-2:2003-12

Simulation model:

Dimensions (width x height): 230,85 x 51,99 mm

Number of elements in simulation model: X-direction: 165; Y-direction: 71



Boundary conditions:

External:

Temperature Θ_e :	0,00	°C
Surface resistance R_{se} :	0,040	m ² K/W

Internal:

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

Results:

Temperature difference dT :	20,00	K
Total heat flow Q :	11,436	W/m
2D thermal conductance $L2D$:	0,572	W/mK

Length 1:	190,00	mm
U-value 1:	1,594	W/m ² K

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

U_f -value:	6,560	W/m ² K
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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 outside 0,04, 0°C, 80%	0,040	0,000	-10,273	X
1 boundary condition inside 0,13, 20°C, 50%	0,130	20,000	9,186	X
1 boundary condition inside 0,20, 20°C, 50%	0,200	20,000	1,087	X
1 air EN ISO 10077-2 (cavities in profiles)				X
1 air EN ISO 10077-2 (cavities in profiles <=2mm)				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
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
3 alu (Si-Leg.) 160	160,000	0,900	X
SZR L=0.0097	0,010	0,900	-

Simulation software: WinIso2D 7.92

Date: 11.07.2014

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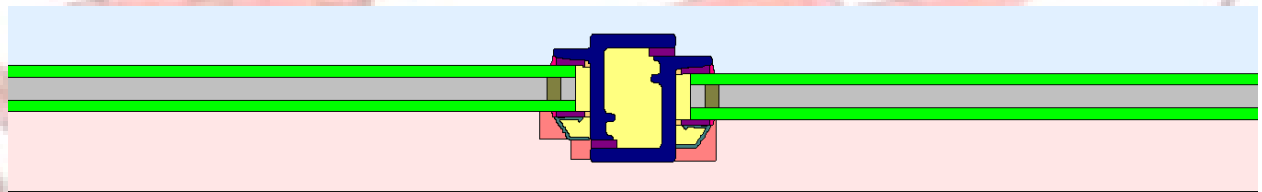


Calculation of the linear thermal transmission coefficient Ψ according to EN ISO 10077-2

Simulation model:

Dimensions (width x height): 435,20 x 64,69 mm

Number of elements in simulation model: X-direction: 305; Y-direction: 105



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 : 16,869 W/m

2D thermal conductance $L2D$: 0,843 W/mK

Length top/left: 190,00 mm

U-value top/left: 1,000 W/m²K

Length bottom/right: 190,00 mm

U-value bottom/right: 1,000 W/m²K

Ψ -value: 0,111 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 outside 0,04, 0°C, 80%	0,040	0,000	-16,869	X
1 boundary condition inside 0,13, 20°C, 50%	0,130	20,000	13,133	X
1 boundary condition inside 0,20, 20°C, 50%	0,200	20,000	3,736	X
1 air EN ISO 10077-2 (cavities in profiles)				X
1 air EN ISO 10077-2 (cavities in profiles <=2mm)				X

Material	L (W/mK)	Emiss	10077 konform
3 structural steel 50	50,000	0,900	X
2 Float Glass 1.0	1,000	0,837	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
3 alu (Si-Leg.) 160	160,000	0,900	X
SZR L=0.0097	0,010	0,900	-

Simulation software: WinIso2D 7.92

Date: 11.07.2014

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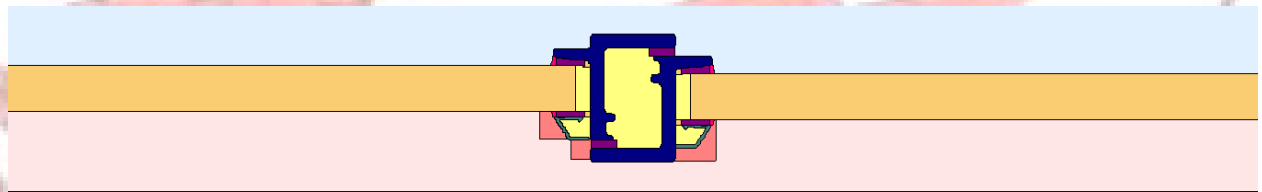


Calculation of the thermal transmission coefficient U_f according to EN ISO 10077-2:2003-12

Simulation model:

Dimensions (width x height): 435,20 x 64,69 mm

Number of elements in simulation model: X-direction: 305; Y-direction: 105



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 : 19,164 W/m

2D thermal conductance L_{2D} : 0,958 W/mK

Length 1: 190,00 mm

U-value 1: 1,595 W/m²K

Length 2: 190,00 mm

U-value 2: 1,595 W/m²K

U_f -value: 6,402 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 outside 0,04, 0°C, 80%	0,040	0,000	-16,869	X
1 boundary condition inside 0,13, 20°C, 50%	0,130	20,000	13,133	X
1 boundary condition inside 0,20, 20°C, 50%	0,200	20,000	3,736	X
1 air EN ISO 10077-2 (cavities in profiles)				X
1 air EN ISO 10077-2 (cavities in profiles <=2mm)				X

Material	L (W/mK)	Emiss	10077 konform
3 structural steel 50	50,000	0,900	X
2 Float Glass 1.0	1,000	0,837	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
3 alu (Si-Leg.) 160	160,000	0,900	X
SZR L=0.0097	0,010	0,900	-