



Cálculo del coeficiente de transmisión térmica (Uf)

Ventana de Rebatir M-Tres (Lateral), con poliamida de 25 - Mediterránea RPT

Cliente:

Alcemar

Cálculos realizados por

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Fecha:

20.04.2006

Resultados

<p>Ventana de rebatir RPT M-3\25 mediante BISCO según norma EN ISO 10077-2:2003</p>	<p>Uf = 3,46 W/m²K</p>
<p>Ventana de rebatir RPT M-3\25 mediante RADCON con "Know-How" TECHNOFORM</p>	<p>Uf = 2,97 W/m²K</p>

En este informe se determina el coeficiente de transmisión térmica (Uf) mediante dos métodos de cálculo diferentes:

- A) Aplicando la norma EN ISO 10077-2:2003, y usando el software "BISCO" de la empresa Physibel.
- B) Aplicando un método propio, "know-how" de Technoform, donde se usa el software "RADCON"- también propiedad de Physibel - y el valor final equivale aproximadamente al resultado en el test de cálculo de nuestra HOT-BOX (La diferencia es de un 5%) según norma ISO/FDIS 12567:2000.

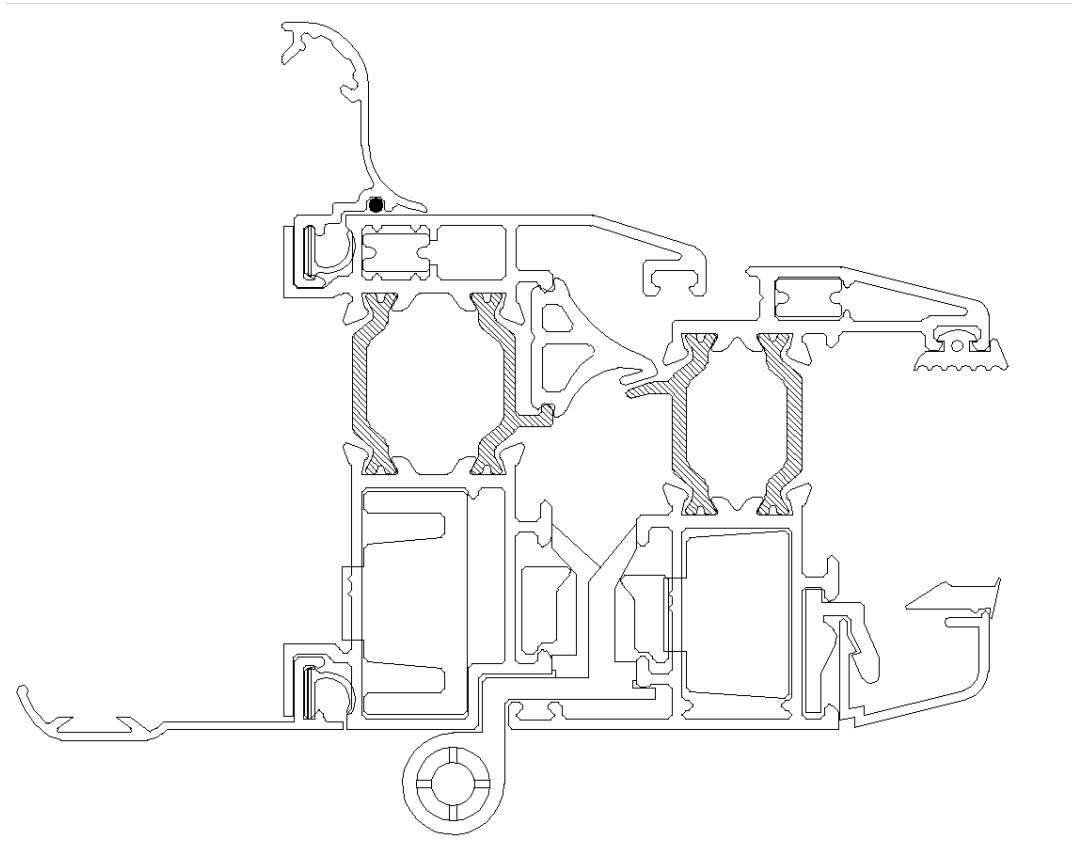


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 - B) **mediante RADCON con “Know-How” TECHNOFORM**
 - **Input – data RADCON**
 - **Output – data RADCON**
 - **Cálculo del coeficiente de transmisión térmica (Uf)**

Dibujo sistema



A) mediante BISCO según norma EN ISO 10077-2:2003

Input – data BISCO

Col.	Name	Type	CEN-rule	Coupled	lambda [W/mK]	eps [-]	t [°C]	h [W/m²K]
8	aluminium	MATERIAL			160.000			
24	aluminium	MATERIAL			160.000			
28	insulation	MATERIAL			0.040			
44	polyamid reinf.	MATERIAL			0.300			
60	EPDM	MATERIAL			0.250			
119	temp. sensor 1	MATERIAL			160.000			
135	temp. sensor 2	MATERIAL			160.000			
151	temp. sensor 3	MATERIAL			160.000			
167	temp. sensor 4	MATERIAL			160.000			
170	exterior	BC_SIMPL	HE				0.0	25.00
174	interior (norma	BC_SIMPL	HI_NORML				20.0	7.70
182	interior (reduc	BC_SIMPL	HI_REduc				20.0	5.00
214	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.170			
215	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.048			
216	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.092			
217	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.108			
218	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.207			
219	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.084			



220	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.095
221	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.042
222	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.139
240	cavity (CEN)	EQUIMAT	CEN_VF_E	NO	0.093
241	cavity (CEN)	EQUIMAT	CEN_VF_E	NO	0.099
242	cavity (CEN)	EQUIMAT	CEN_VF_E	NO	0.087
243	cavity (CEN)	EQUIMAT	CEN_VF_E	NO	0.088
248	cavity <6x6 mm2	MATERIAL			0.043
250	cavity <4x4 mm2	MATERIAL			0.037
251	cavity <3x3 mm2	MATERIAL			0.034
252	cavity <2x2 mm2	MATERIAL			0.031
253	cavity <1x1 mm2	MATERIAL			0.028

Col.	q [W/m ²]	ta [°C]	hc [W/m ² K]	qc [W/m]	tr [°C]	C1 [-]	C2 [-]	C3 [-]
8								
24								
28								
44								
60								
119								
135								
151								
167								
170	0							
174	0							
182	0							
214						0.025	0.73	0.333333
215						0.025	0.73	0.333333
216						0.025	0.73	0.333333
217						0.025	0.73	0.333333
218						0.025	0.73	0.333333
219						0.025	0.73	0.333333
220						0.025	0.73	0.333333
221						0.025	0.73	0.333333
222						0.025	0.73	0.333333
240						0.025	0.73	0.333333
241						0.025	0.73	0.333333
242						0.025	0.73	0.333333
243						0.025	0.73	0.333333
248								
250								
251								
252								
253								



Calculation parameters

Contour approximation margin (triangulation) = 0 pixels
Iteration cycles = 5
Recalculation of CEN values (before each iteration cycle)
Maximum number of iterations (per iteration cycle) = 10000
Maximum temperature difference = 0.0001°C
Max. heat flow divergence for total object = 0.001 %
Max. heat flow divergence for any node = 1 %



Output – data BISCO

Col.	Name	Type	tmin [°C]	tmax [°C]	ta [°C]	flow in [W/m]	flow out [W/m]
8	aluminium	MATERIAL	2.13	13.11			
24	aluminium	MATERIAL	2.17	12.99			
28	insulation	MATERIAL	0.90	17.02			
44	polyamid reinf.	MATERIAL	2.21	12.82			
60	EPDM	MATERIAL	1.80	13.76			
119	temp. sensor 1	MATERIAL	11.61	11.61			
135	temp. sensor 2	MATERIAL	12.95	12.95			
151	temp. sensor 3	MATERIAL	13.08	13.08			
167	temp. sensor 4	MATERIAL	15.26	15.26			
170	exterior	BC_SIMPL	0.90	2.64		0.00	10.59
174	interior (norma	BC_SIMPL	11.60	17.02		9.73	0.00
182	interior (reduc	BC_SIMPL	13.10	16.33		0.87	0.00
214	cavity (CEN)	EQUIMAT	2.22	11.59			
215	cavity (CEN)	EQUIMAT	2.17	2.22			
216	cavity (CEN)	EQUIMAT	2.22	11.46			
217	cavity (CEN)	EQUIMAT	11.46	11.62			
218	cavity (CEN)	EQUIMAT	2.13	12.97			
219	cavity (CEN)	EQUIMAT	2.68	12.81			
220	cavity (CEN)	EQUIMAT	12.81	12.99			
221	cavity (CEN)	EQUIMAT	2.59	2.67			
222	cavity (CEN)	EQUIMAT	2.62	13.66			
240	cavity (CEN)	EQUIMAT	1.25	2.22			
241	cavity (CEN)	EQUIMAT	11.58	13.07			
242	cavity (CEN)	EQUIMAT	11.59	13.34			
243	cavity (CEN)	EQUIMAT	1.52	2.70			
248	cavity <6x6 mm2	MATERIAL	2.20	9.49			
250	cavity <4x4 mm2	MATERIAL	11.70	13.03			
251	cavity <3x3 mm2	MATERIAL	2.59	4.02			
252	cavity <2x2 mm2	MATERIAL	2.59	13.03			
253	cavity <1x1 mm2	MATERIAL	2.07	13.20			



Cálculo del coeficiente de transmisión térmica (Uf)

THERMAL TRANSMITTANCE ACCORDING TO prEN 10077-2

Theory

The thermal transmittance of a frame according to PrEN 10077-2:

$$U_f = \frac{L_{2D} - U_p * l_p}{l_f} \quad \text{and} \quad L_{2D} = \frac{q_{l,tot}}{\Delta \theta}$$

- with:
- U_f : thermal transmittance of the window frame [W/m²K]
 - U_p : thermal transmittance of the flanking panel [W/m²K]
 - l_p : projected width of the flanking panel [m]
 - l_f : projected width of the window frame [m]
 - L_{2D} : two-dimensional coupling coefficient [W/mK]
 - $q_{l,tot}$: total heat flow through the window frame and the flanking panel [W/m]
 - $\Delta \theta$: temperature difference between inside (θ_i) and outside (θ_e) [K]

Calculation	Item:		
input data:	$q_{l,tot} =$	10,59 W/m	$R_{se} =$ 0,04 m ² K/W
	$\theta_e =$	0,0 °C	$R_{si} =$ 0,13 m ² K/W
	$\theta_i =$	20,0 °C	
	$d_i =$	0,0280 m	
	$\lambda_i =$	0,035 W/m*K	
	$U_p =$	1,031 W/m ² K	
	$l_p =$	0,190 m	
	calculation results:	$L_{2D} =$ 0,53 W/mK	
	$l_f =$	0,0963 m	$U_f =$ 3,46 W/m ² K

input data using the Physibel Software BISCO

- $q_{l,tot}$: alphanumeric output BISCO
- $\Delta \theta$: heat losses per boundary condition
- U_p : input data, surface boundary conditions: inside temperature minus outside temperature
- l_p / l_f : calculation, using the following formula:

$$U_p = \left[\frac{1}{h_e} + \sum \frac{d_i}{\lambda_i} + \frac{1}{h_i} \right]^{-1}$$

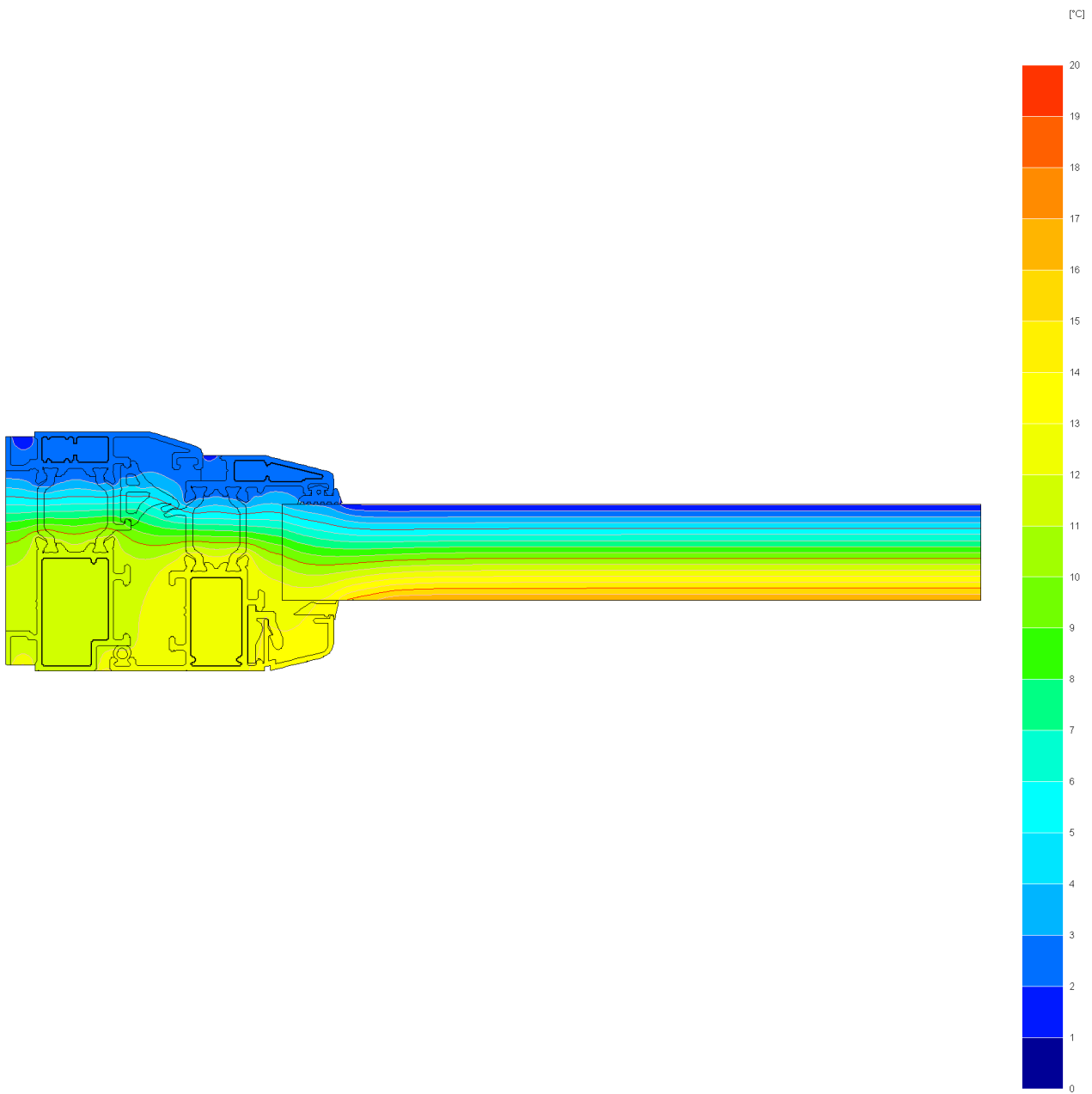
- with: h_e / h_i ext./int. surface heat transfer coeff. [W/m²K]
- d_i thickness of layer i [m]
- λ_i thermal conductivity of layer i [W/mK]

- l_p / l_f : input data: dimensions of the item

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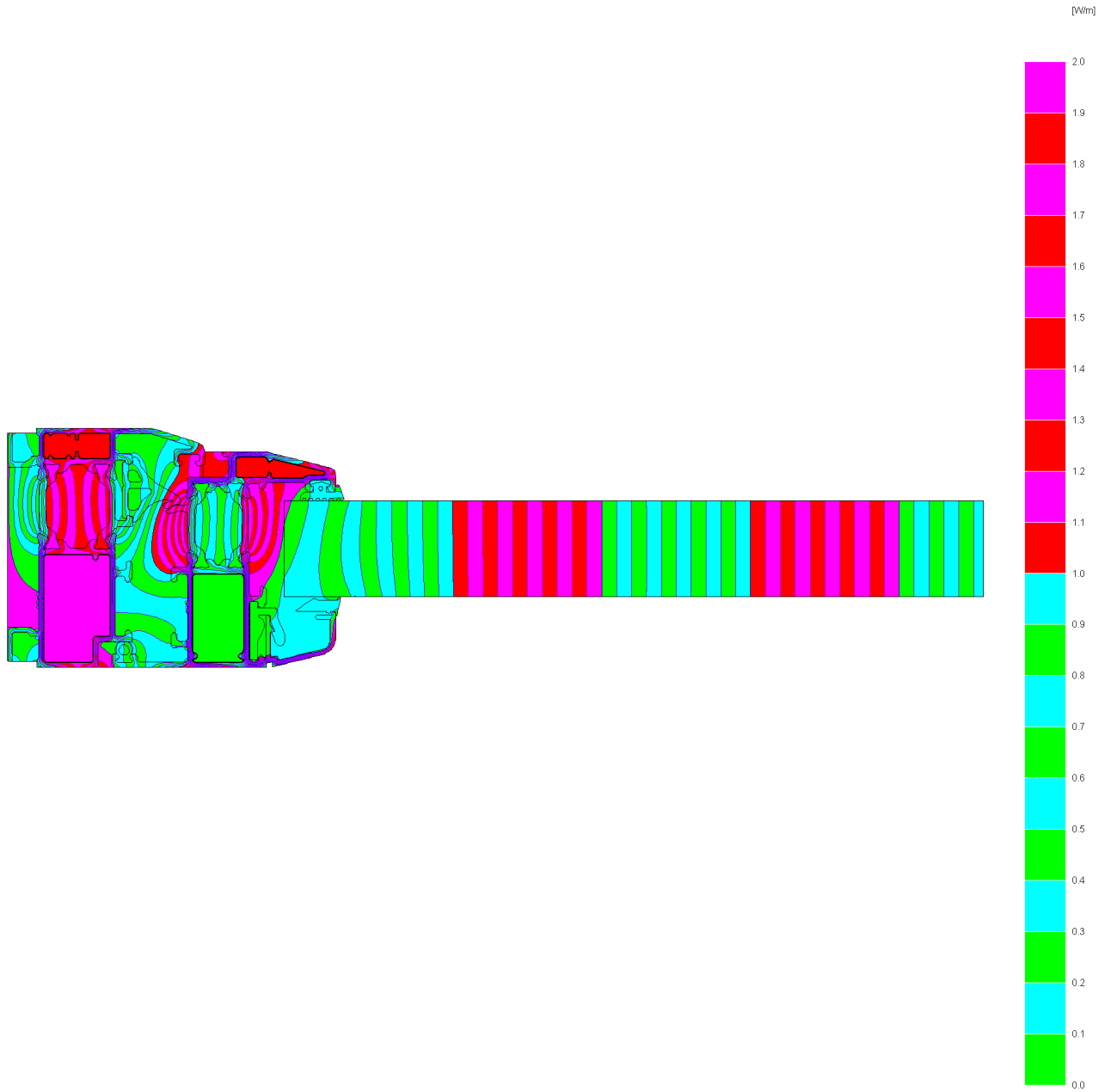


Isotermas





Flujo de calor





B) mediante RADCON con “Know-How” TECHNOFORM

Input – data RADCON

Col.	Name	Type	CEN-rule	Coupled	lambda [W/mK]	eps [-]	t [°C]	h [W/m²K]
8	aluminium	MATERIAL			160.000	0.90		
24	aluminium epsil	MATERIAL			160.000	0.30		
28	insulation	MATERIAL			0.035	0.90		
44	polyamid reinf.	MATERIAL			0.300	0.90		
60	EPDM	MATERIAL			0.250	0.90		
100	interior 4	BC_SKY	NIHIL					
119	temp. sensor 1	MATERIAL			160.000	0.90		
135	temp. sensor 2	MATERIAL			160.000	0.90		
151	temp. sensor 3	MATERIAL			160.000	0.90		
156	insulation far	MATERIAL			0.035	0.90		
167	temp. sensor 4	MATERIAL			160.000	0.90		
170	exterior	BC_SKY	NIHIL					
174	interior 1	BC_SKY	NIHIL					
182	interior 2	BC_SKY	NIHIL					
190	interior 3	BC_SKY	NIHIL					
214	cavity	BC_FREE	CEN_VF_I	NO				
215	cavity	EQUIMAT	CEN_VF_I	NO	0.047	0.90		
216	cavity	BC_FREE	CEN_VF_I	NO				
217	cavity	BC_FREE	CEN_VF_I	NO				
218	cavity	EQUIMAT	CEN_VF_I	NO	0.191	0.90		
219	cavity	BC_FREE	CEN_VF_I	NO				
220	cavity	BC_FREE	CEN_VF_I	NO				
221	cavity	EQUIMAT	CEN_VF_I	NO	0.042	0.90		
222	cavity	EQUIMAT	CEN_VF_I	NO	0.128	0.90		
240	cavity	EQUIMAT	CEN_VF_E	NO	0.092	0.90		
241	cavity	EQUIMAT	CEN_VF_E	NO	0.100	0.90		
242	cavity	EQUIMAT	CEN_VF_E	NO	0.086	0.90		
243	cavity	EQUIMAT	CEN_VF_E	NO	0.088	0.90		
248	cavity <6x6 mm2	MATERIAL			0.043	0.90		
250	cavity <4x4 mm2	MATERIAL			0.037	0.90		
251	cavity <3x3 mm2	MATERIAL			0.034	0.90		
252	cavity <2x2 mm2	MATERIAL			0.031	0.90		
253	cavity <1x1 mm2	MATERIAL			0.028	0.90		

Col.	q [W/m²]	ta [°C]	hc [W/m²K]	qc [W/m]	tr [°C]	C1 [-]	C2 [-]	C3 [-]
8								
24								
28								
44								
60								
100	0	20.0	2.88		20.0			
119								
135								
151								
156								



167								
170	0	0.0	12.00		0.0			
174	0	20.0	2.33		20.0			
182	0	20.0	2.65		20.0			
190	0	20.0	3.02		20.0			
214	0		2.02	0		0.0247	0.58	0.25
215						0.0243	0.58	0.25
216	0		2.29	0		0.0247	0.58	0.25
217	0		1.66	0		0.0251	0.58	0.25
218						0.0247	0.58	0.333333
219	0		2.48	0		0.0248	0.58	0.333333
220	0		1.97	0		0.0252	0.58	0.25
221						0.0244	0.58	0.25
222						0.0248	0.58	0.333333
240						0.0243	0.58	0.25
241						0.0252	0.58	0.25
242						0.0243	0.58	0.25
243						0.0246	0.58	0.25
248								
250								
251								
252								
253								

Calculation parameters

Contour approximation margin (triangulation) = 0 pixels

Iteration cycles = 5

Nonlinear radiation

Recalculation of CEN values (before each iteration cycle)

Smallest accepted viewfactor = 0.001

Number of visibility rays between radiative surfaces = 100

Black radiation heat transfer coeff. (linear radiation) = 5.25 W/m²K

Maximum number of iterations (per iteration cycle) = 10000

Maximum temperature difference = 0.0001°C

Max. heat flow divergence for total object = 0.001 %

Max. heat flow divergence for any node = 1 %



Output – data RADCON

Col.	Name	Type	tmin [°C]	tmax [°C]	ta [°C]	flow in [W/m]	flow out [W/m]
8	aluminium	MATERIAL	3.08	13.82			
24	aluminium epsil	MATERIAL	3.10	13.69			
28	insulation	MATERIAL	1.30	16.82			
44	polyamid reinf.	MATERIAL	3.15	13.53			
60	EPDM	MATERIAL	2.78	14.52			
100	interior 4	BC_SKY	12.57	14.04		3.49	0.00
119	temp. sensor 1	MATERIAL	12.34	12.34			
135	temp. sensor 2	MATERIAL	13.66	13.66			
151	temp. sensor 3	MATERIAL	13.78	13.78			
156	insulation far	MATERIAL	1.23	17.30			
167	temp. sensor 4	MATERIAL	16.07	16.07			
170	exterior	BC_SKY	1.23	3.69		0.00	9.56
174	interior 1	BC_SKY	16.82	17.30		3.50	0.00
182	interior 2	BC_SKY	13.80	16.82		0.98	0.00
190	interior 3	BC_SKY	12.33	13.67		1.59	0.00
214	cavity	BC_FREE	3.15	12.32	9.14	0.68	0.68
215	cavity	EQUIMAT	3.10	3.15			
216	cavity	BC_FREE	3.15	12.22	7.84	0.84	0.84
217	cavity	BC_FREE	12.22	12.36	12.28	0.01	0.01
218	cavity	EQUIMAT	3.08	13.67			
219	cavity	BC_FREE	3.73	13.52	8.65	0.73	0.73
220	cavity	BC_FREE	13.52	13.69	13.60	0.01	0.01
221	cavity	EQUIMAT	3.64	3.72			
222	cavity	EQUIMAT	3.67	14.43			
240	cavity	EQUIMAT	2.11	3.15			
241	cavity	EQUIMAT	12.31	13.67			
242	cavity	EQUIMAT	12.33	14.04			
243	cavity	EQUIMAT	2.47	3.75			
248	cavity <6x6 mm2	MATERIAL	3.14	10.27			
250	cavity <4x4 mm2	MATERIAL	12.43	13.72			
251	cavity <3x3 mm2	MATERIAL	3.53	4.98			
252	cavity <2x2 mm2	MATERIAL	3.65	13.72			
253	cavity <1x1 mm2	MATERIAL	3.06	13.95			



Cálculo del coeficiente de transmisión térmica (Uf)

THERMAL TRANSMITTANCE ACCORDING TO prEN 10077-2

Theory

The thermal transmittance of a frame according to PrEN 10077-2:

$$U_f = \frac{L_{2D} - U_p * l_p}{l_f} \quad \text{and} \quad L_{2D} = \frac{q_{l,tot}}{\Delta \theta}$$

- with:
- U_f : thermal transmittance of the window frame [W/m²K]
 - U_p : thermal transmittance of the flanking panel [W/m²K]
 - l_p : projected width of the flanking panel [m]
 - l_f : projected width of the window frame [m]
 - L_{2D} : two-dimensional coupling coefficient [W/mK]
 - $q_{l,tot}$: total heat flow through the window frame and the flanking panel [W/m]
 - $\Delta \theta$: temperature difference between inside (θ_i) and outside (θ_e) [K]

Calculation	Item:		
input data:	$q_{l,tot} = 9,56$ W/m	$R_{se} = 0,06$ m ² K/W	
	$\theta_e = 0,0$ °C	$R_{si} = 0,13$ m ² K/W	
	$\theta_i = 20,0$ °C		
	$d_i = 0,0280$ m		
	$\lambda_i = 0,035$ W/m*K		
	$U_p = 1,010$ W/m ² K		
	$l_p = 0,190$ m		
	calculation results:	$L_{2D} = 0,48$ W/mK	
	$l_f = 0,0963$ m	$U_f = 2,97$ W/m ² K	

input data using the Physibel Software BISCO

- $q_{l,tot}$: alphanumeric output BISCO
heat losses per boundary condition
- $\Delta \theta$: input data, surface boundary conditions:
inside temperature minus outside temperature
- U_p : calculation, using the following formula:

$$U_p = \left[\frac{1}{h_e} + \sum \frac{d_i}{\lambda_i} + \frac{1}{h_i} \right]^{-1}$$

- with: h_e / h_i : ext./int. surface heat transfer coeff. [W/m²K]
- d_i : thickness of layer i [m]
- λ_i : thermal conductivity of layer i [W/mK]
- l_p / l_f : input data: dimensions of the item

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