Cálculo del coeficiente de transmisión térmica (Uf)

Ventana y Puerta Corrediza M-Cinco (Encuentro central) – Mediterránea RPT

Cliente: ***Alcemar***

Cálculos realizados por **Technoform BAUTEC Ibérica, s.l.**
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Resultados

Encuentro de hojas mediante BISCO según norma EN ISO 10077-2:2003	**Uf = 7,68 W/m²K**
Encuentro de hojas mediante RADCON con "Know-How" TECHNOFORM	**Uf = 6,65 W/m²K**

En este informe se detemina 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 própio, "know-how" de Technoform, dónde 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.

Contenido

- Dibujo sistema

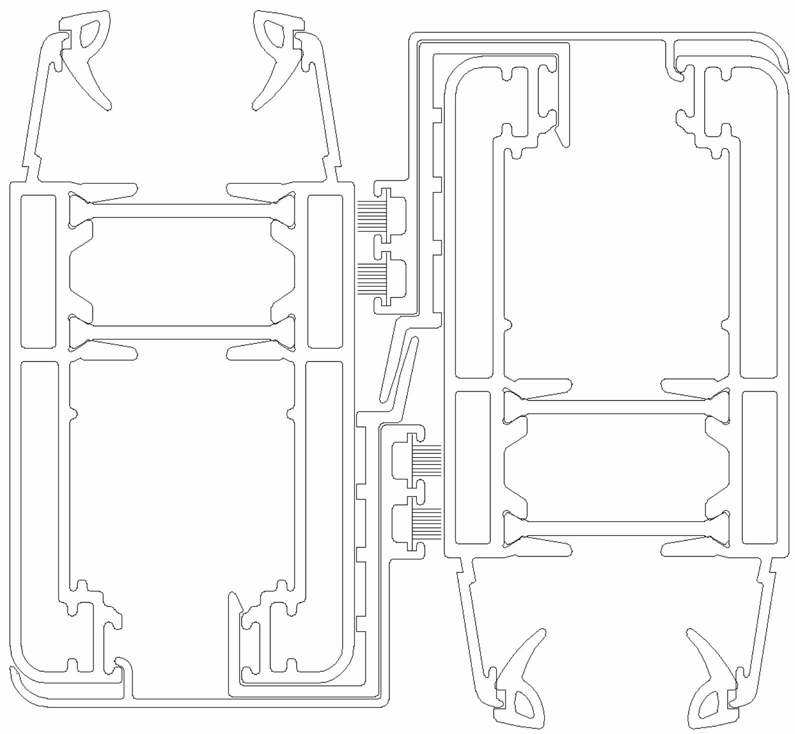
A) mediante BISCO según norma EN ISO 10077-2:2003

- Input – data BISCO
- Output – data BISCO
- Cálculo del coeficiente de transmisión térmica (Uf)
- Isotermas
- Flujo de calor

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			0.035			
44	polyamid reinf.	MATERIAL			0.300			
60	EPDM	MATERIAL			0.250			
67	PVC flexible	MATERIAL			0.140			
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	0.051			
215	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.041			
216	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.111			
217	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.098			
218	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.097			
219	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.051			
220	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.041			
221	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.042			
222	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.119			
224	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.106			
225	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.105			
226	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.043			
227	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.053			
228	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.049			
229	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.047			
231	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.051			
235	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.052			
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/m²]	ta [°C]	hc [W/m²K]	qc [W/m]	tr [°C]	C1 [-]	C2 [-]	C3 [-]
8								
24								
28								
44								
60								
67								
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
224	0.025	0.73	0.333333
225	0.025	0.73	0.333333
226	0.025	0.73	0.333333
227	0.025	0.73	0.333333
228	0.025	0.73	0.333333
229	0.025	0.73	0.333333
231	0.025	0.73	0.333333
235	0.025	0.73	0.333333
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	1.47	11.36			
24	aluminium	MATERIAL	1.51	11.27			
28	insulation	MATERIAL	0.81	16.36			
44	polyamid reinf.	MATERIAL	1.52	11.25			
60	EPDM	MATERIAL	1.02	13.12			
67	PVC flexible	MATERIAL	2.00	10.40			
119	temp. sensor 1	MATERIAL	16.03	16.03			
135	temp. sensor 2	MATERIAL	11.10	11.10			
151	temp. sensor 3	MATERIAL	10.04	10.04			
167	temp. sensor 4	MATERIAL	14.48	14.48			
170	exterior	BC_SIMPL	0.81	6.52		0.00	19.19
174	interior (norma	BC_SIMPL	10.90	16.36		10.92	0.00
182	interior (reduc	BC_SIMPL	4.89	15.69		8.27	0.00
214	cavity (CEN)	EQUIMAT	1.55	1.70			
215	cavity (CEN)	EQUIMAT	1.51	1.56			
216	cavity (CEN)	EQUIMAT	1.56	4.73			
217	cavity (CEN)	EQUIMAT	1.53	4.83			
218	cavity (CEN)	EQUIMAT	1.47	5.18			
219	cavity (CEN)	EQUIMAT	4.42	4.73			
220	cavity (CEN)	EQUIMAT	4.73	4.89			
221	cavity (CEN)	EQUIMAT	6.52	6.76			
222	cavity (CEN)	EQUIMAT	6.76	11.16			
224	cavity (CEN)	EQUIMAT	6.61	11.22			
225	cavity (CEN)	EQUIMAT	6.18	11.40			
226	cavity (CEN)	EQUIMAT	11.17	11.27			
227	cavity (CEN)	EQUIMAT	10.87	11.19			
228	cavity (CEN)	EQUIMAT	10.79	10.93			
229	cavity (CEN)	EQUIMAT	1.67	1.75			
231	cavity (CEN)	EQUIMAT	2.55	9.66			
235	cavity (CEN)	EQUIMAT	6.76	7.20			
250	cavity <4x4 mm2	MATERIAL	1.31	12.57			
251	cavity <3x3 mm2	MATERIAL	1.13	12.72			
252	cavity <2x2 mm2	MATERIAL	1.36	11.69			
253	cavity <1x1 mm2	MATERIAL	1.52	11.25			

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/m^{2}K]
- U_p : thermal transmittance of the flanking panel [W/m^{2}K]
- 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 (θi) and outside (θe) [K]

Calculation — Item:

input data:	$q_{l,tot}$ =	19,190	W/m	R_{se} =	0,04	m^{2}K/W
	θ_e =	0,0	°C	R_{si} =	0,13	m^{2}K/W
	θ_i =	20,0	°C			
	d_i =	0,0190	m			
	λ_i =	0,035	W/m*K			
	U_p =	1,403	W/m^{2}K			
	l_p =	0,190	m			
				calculation results: L_{2D} =	0,96	W/mK
	l_f =	0,0902	m	**U_f =**	**7,68**	**W/m^{2}K**

input data using the Physibel Software BISCO

- $q_{l,tot}$: alphanumeric output BISKO
  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/m^{2}K]
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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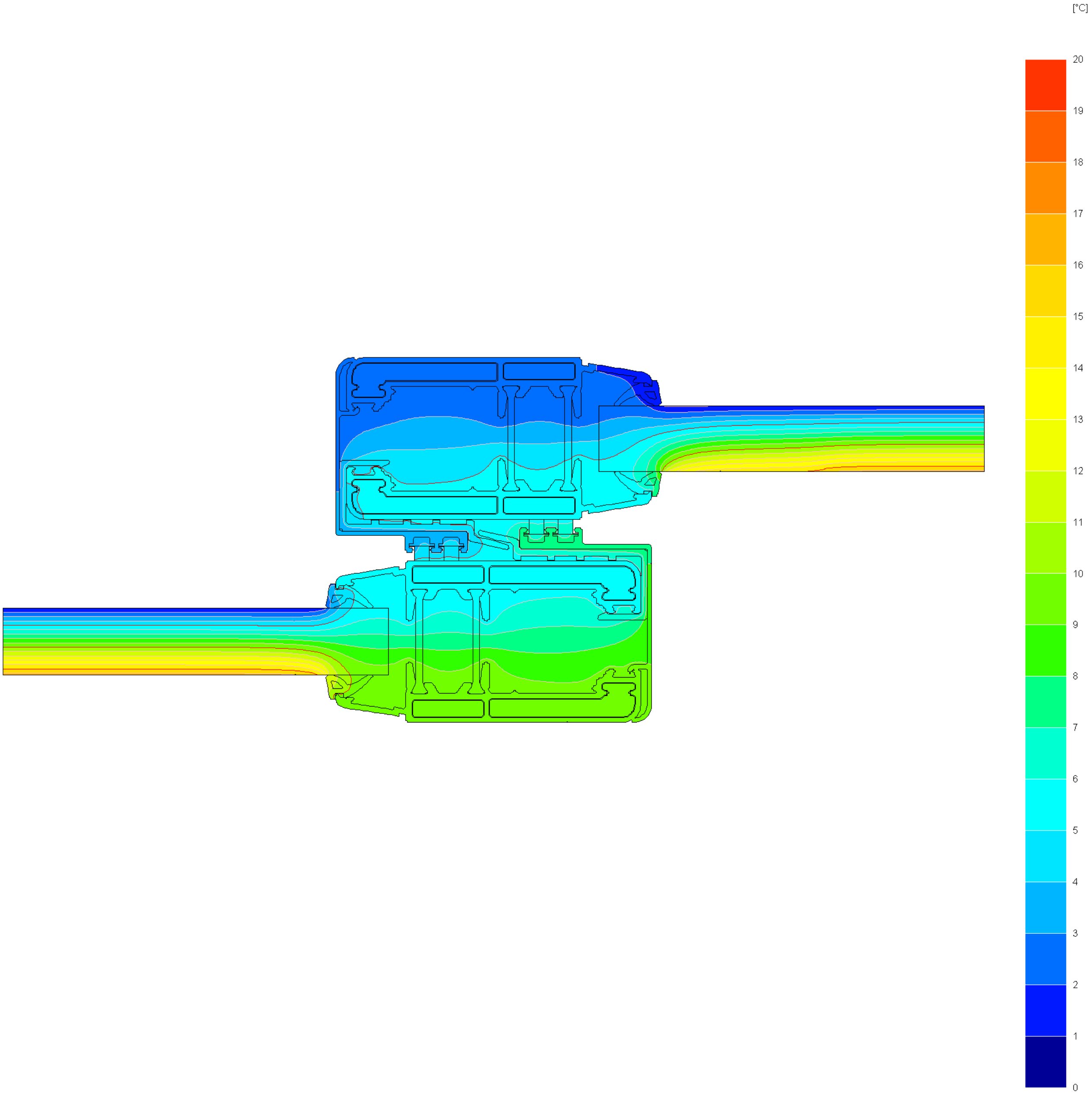
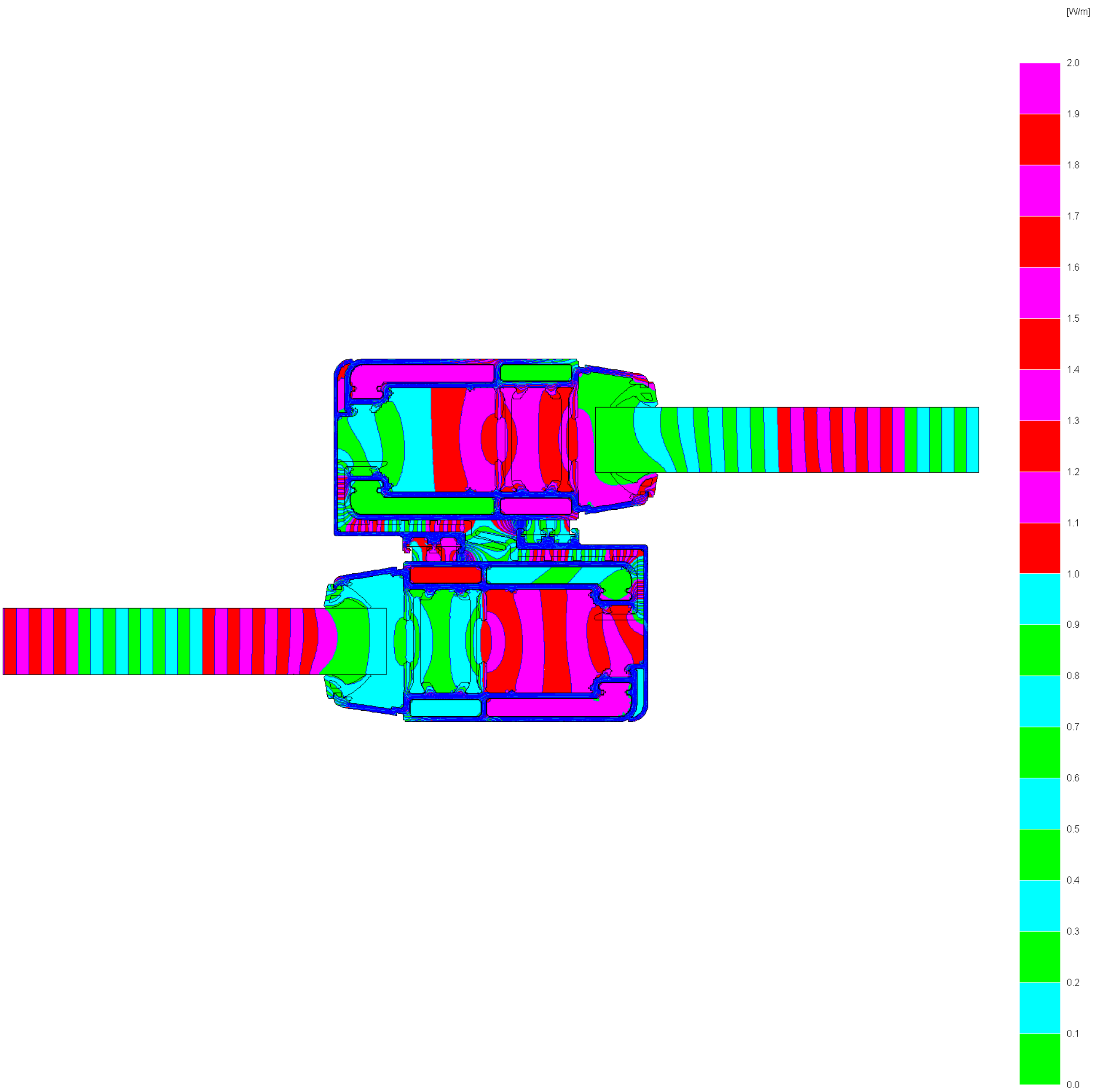
Isotermas



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/m^2K]
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		
67	PVC flexible	MATERIAL			0.140	0.90		
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	EQUIMAT	CEN_VF_I	NO	0.050	0.90		
215	cavity	EQUIMAT	CEN_VF_I	NO	0.040	0.90		
216	cavity	BC_FREE	CEN_VF_I	NO				
217	cavity	BC_FREE	CEN_VF_I	NO				
218	cavity	BC_FREE	CEN_VF_I	NO				
219	cavity	EQUIMAT	CEN_VF_I	NO	0.051	0.90		
220	cavity	EQUIMAT	CEN_VF_I	NO	0.041	0.90		
221	cavity	EQUIMAT	CEN_VF_I	NO	0.042	0.90		
222	cavity	BC_FREE	CEN_VF_I	NO				
224	cavity	BC_FREE	CEN_VF_I	NO				
225	cavity	BC_FREE	CEN_VF_I	NO				
226	cavity	EQUIMAT	CEN_VF_I	NO	0.043	0.90		
227	cavity	EQUIMAT	CEN_VF_I	NO	0.054	0.90		
228	cavity	EQUIMAT	CEN_VF_I	NO	0.049	0.90		
229	cavity	EQUIMAT	CEN_VF_I	NO	0.046	0.90		
231	cavity	EQUIMAT	CEN_VF_I	NO	0.051	0.90		
235	cavity	EQUIMAT	CEN_VF_I	NO	0.052	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/m^2]	ta [°C]	hc [W/m^2K]	qc [W/m]	tr [°C]	C1 [-]	C2 [-]	C3 [-]
8								
24								
28								
44								
60								
67								
119								
135								
151								
156								
167								
170	0	0.0	12.00		0.0			

174	0	20.0	3.15		20.0			
182	0	20.0	2.71		20.0			
190	0	20.0	2.42		20.0			
214						0.0243	0.58	0.25
215						0.0243	0.58	0.25
216	0		1.82	0		0.0244	0.58	0.25
217	0		1.74	0		0.0244	0.58	0.25
218	0		1.78	0		0.0244	0.58	0.25
219						0.0246	0.58	0.25
220						0.0246	0.58	0.25
221						0.0247	0.58	0.25
222	0		1.85	0		0.0249	0.58	0.25
224	0		1.78	0		0.0249	0.58	0.25
225	0		1.83	0		0.0249	0.58	0.25
226						0.025	0.58	0.25
227						0.025	0.58	0.25
228						0.025	0.58	0.25
229						0.0243	0.58	0.25
231						0.0246	0.58	0.25
235						0.0247	0.58	0.25
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	2.56	12.47			
24	aluminium epsil	MATERIAL	2.60	12.41			
28	insulation	MATERIAL	1.41	16.36			
44	polyamid reinf.	MATERIAL	2.61	12.39			
60	EPDM	MATERIAL	1.93	13.51			
67	PVC flexible	MATERIAL	3.18	11.62			
119	temp. sensor 1	MATERIAL	15.90	15.90			
135	temp. sensor 2	MATERIAL	12.27	12.27			
151	temp. sensor 3	MATERIAL	11.25	11.26			
156	insulation far	MATERIAL	1.59	16.37			
167	temp. sensor 4	MATERIAL	14.58	14.58			
170	exterior	BC_SKY	1.41	8.23		0.00	17.18
174	interior 1	BC_SKY	12.17	12.90		5.16	0.00
182	interior 2	BC_SKY	5.98	15.43		7.84	0.00
190	interior 3	BC_SKY	12.89	16.37		4.18	0.00
214	cavity	EQUIMAT	2.64	2.83			
215	cavity	EQUIMAT	2.60	2.65			
216	cavity	BC_FREE	2.66	5.83	4.06	0.75	0.75
217	cavity	BC_FREE	2.63	5.92	4.24	0.22	0.22
218	cavity	BC_FREE	2.56	6.38	4.38	0.27	0.27
219	cavity	EQUIMAT	5.55	5.84			
220	cavity	EQUIMAT	5.84	5.98			
221	cavity	EQUIMAT	8.23	8.42			
222	cavity	BC_FREE	8.42	12.32	10.59	0.96	0.96
224	cavity	BC_FREE	8.30	12.37	10.37	0.29	0.29
225	cavity	BC_FREE	7.76	12.47	10.25	0.34	0.34
226	cavity	EQUIMAT	12.33	12.40			
227	cavity	EQUIMAT	12.06	12.34			
228	cavity	EQUIMAT	11.99	12.11			
229	cavity	EQUIMAT	2.79	2.88			
231	cavity	EQUIMAT	3.78	10.92			
235	cavity	EQUIMAT	8.42	8.78			
250	cavity <4x4 mm2	MATERIAL	2.22	13.14			
251	cavity <3x3 mm2	MATERIAL	2.06	13.32			
252	cavity <2x2 mm2	MATERIAL	2.40	12.76			
253	cavity <1x1 mm2	MATERIAL	2.61	12.39			

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 (θi) and outside (θe) [K]

Calculation — Item:

input data:	$q_{l,tot}$ =	17,180	W/m		R_{se} =	0,06	m²K/W
	θ_e =	0,0	°C		R_{si} =	0,13	m²K/W
	θ_i =	20,0	°C				
	d_i =	0,0190	m				
	λ_i =	0,035	W/m*K				
	U_p =	1,365	W/m²K				
	l_p =	0,190	m				
				calculation results:	L_{2D} =	0,86	W/mK
	l_f =	0,0902	m		**U_f =**	**6,65**	**W/m²K**

input data using the Physibel Software BISCO

$q_{l,tot}$:	alphanumeric output BISKO 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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