Cálculo del coeficiente de transmisión térmica (Uf)

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

Cliente: ***Alcemar***

Cálculos realizados por

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Resultados

Corredera cerco y hoja interior corta mediante BISCO según norma EN ISO 10077-2:2003	**Uf = 5,95 W/m^{2}K**
Corredera cerco y hoja interior corta mediante RADCON con "Know-How" TECHNOFORM	**Uf = 4,57 W/m^{2}K**

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**

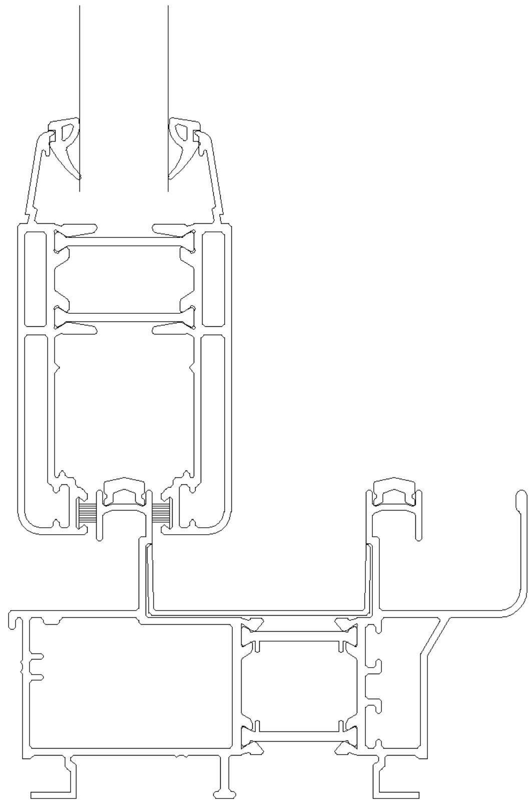
A) <u>mediante BISCO según norma EN ISO 10077-2:2003</u>

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

B) <u>mediante RADCON con "Know-How" TECHNOFORM</u>

- **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
214	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.107			
215	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.122			
216	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.139			
217	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.098			
218	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.065			
219	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.053			
220	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.128			
221	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.050			
222	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.042			
223	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.115			
224	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.041			

225	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.113
240	cavity (CEN)	EQUIMAT	CEN_VF_E	NO	0.098
242	cavity (CEN)	EQUIMAT	CEN_VF_E	NO	0.094
247	cavity <7x7 mm2	MATERIAL			0.046
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							
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
223						0.025	0.73	0.333333
224						0.025	0.73	0.333333
225						0.025	0.73	0.333333
240						0.025	0.73	0.333333
242						0.025	0.73	0.333333
247								
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	0.26	12.91			
24	aluminium	MATERIAL	0.31	12.87			
28	insulation	MATERIAL	1.10	16.35			

44	polyamid reinf.	MATERIAL	0.34	12.82		
60	EPDM	MATERIAL	1.76	13.93		
67	PVC flexible	MATERIAL	0.22	8.51		
119	temp. sensor 1	MATERIAL	8.79	8.79		
135	temp. sensor 2	MATERIAL	8.51	8.51		
151	temp. sensor 3	MATERIAL	12.86	12.87		
167	temp. sensor 4	MATERIAL	12.89	12.89		
170	exterior	BC_SIMPL	0.21	8.52	0.00	22.44
174	interior (norma	BC_SIMPL	8.51	16.35	22.44	0.00
214	cavity (CEN)	EQUIMAT	8.45	8.73		
215	cavity (CEN)	EQUIMAT	0.37	8.45		
216	cavity (CEN)	EQUIMAT	8.35	8.81		
217	cavity (CEN)	EQUIMAT	0.35	8.41		
218	cavity (CEN)	EQUIMAT	0.31	0.37		
219	cavity (CEN)	EQUIMAT	12.72	12.87		
220	cavity (CEN)	EQUIMAT	2.63	12.79		
221	cavity (CEN)	EQUIMAT	2.55	2.73		
222	cavity (CEN)	EQUIMAT	12.80	12.85		
223	cavity (CEN)	EQUIMAT	2.60	12.81		
224	cavity (CEN)	EQUIMAT	2.56	2.62		
225	cavity (CEN)	EQUIMAT	2.50	12.91		
240	cavity (CEN)	EQUIMAT	8.72	10.69		
242	cavity (CEN)	EQUIMAT	0.21	0.37		
247	cavity <7x7 mm2	MATERIAL	0.27	8.52		
250	cavity <4x4 mm2	MATERIAL	0.28	13.30		
251	cavity <3x3 mm2	MATERIAL	1.92	13.63		
252	cavity <2x2 mm2	MATERIAL	2.48	12.95		
253	cavity <1x1 mm2	MATERIAL	0.34	12.82		

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:	$q_{l,tot}$ =	22,440	W/m		R_{se} =	0,04	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 =	1,403	W/m²K				
	l_p =	0,190	m				
				calculation results:	L_{2D} =	1,12	W/mK
	l_f =	0,1437	m		**U_f =**	**5,95**	**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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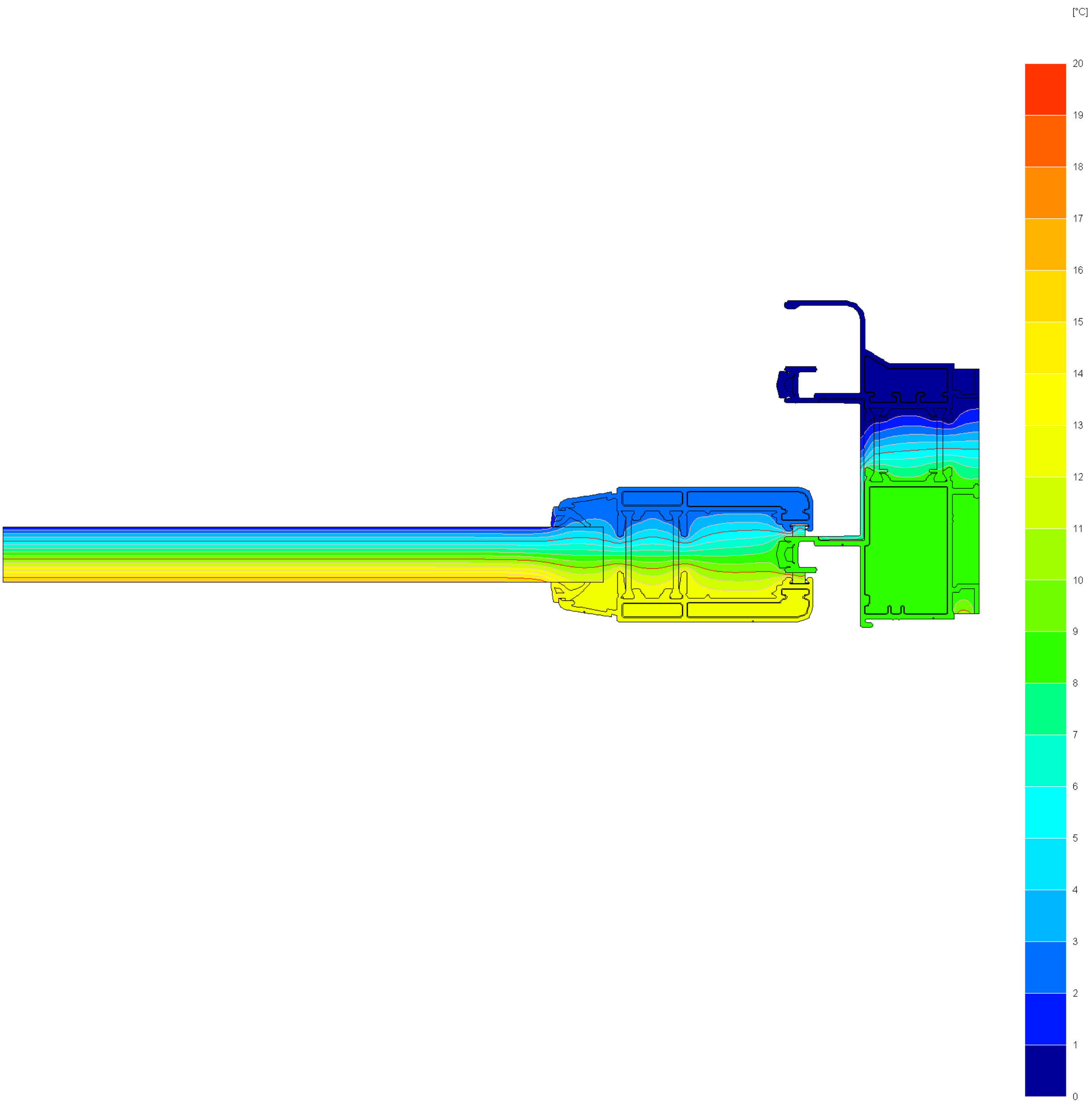
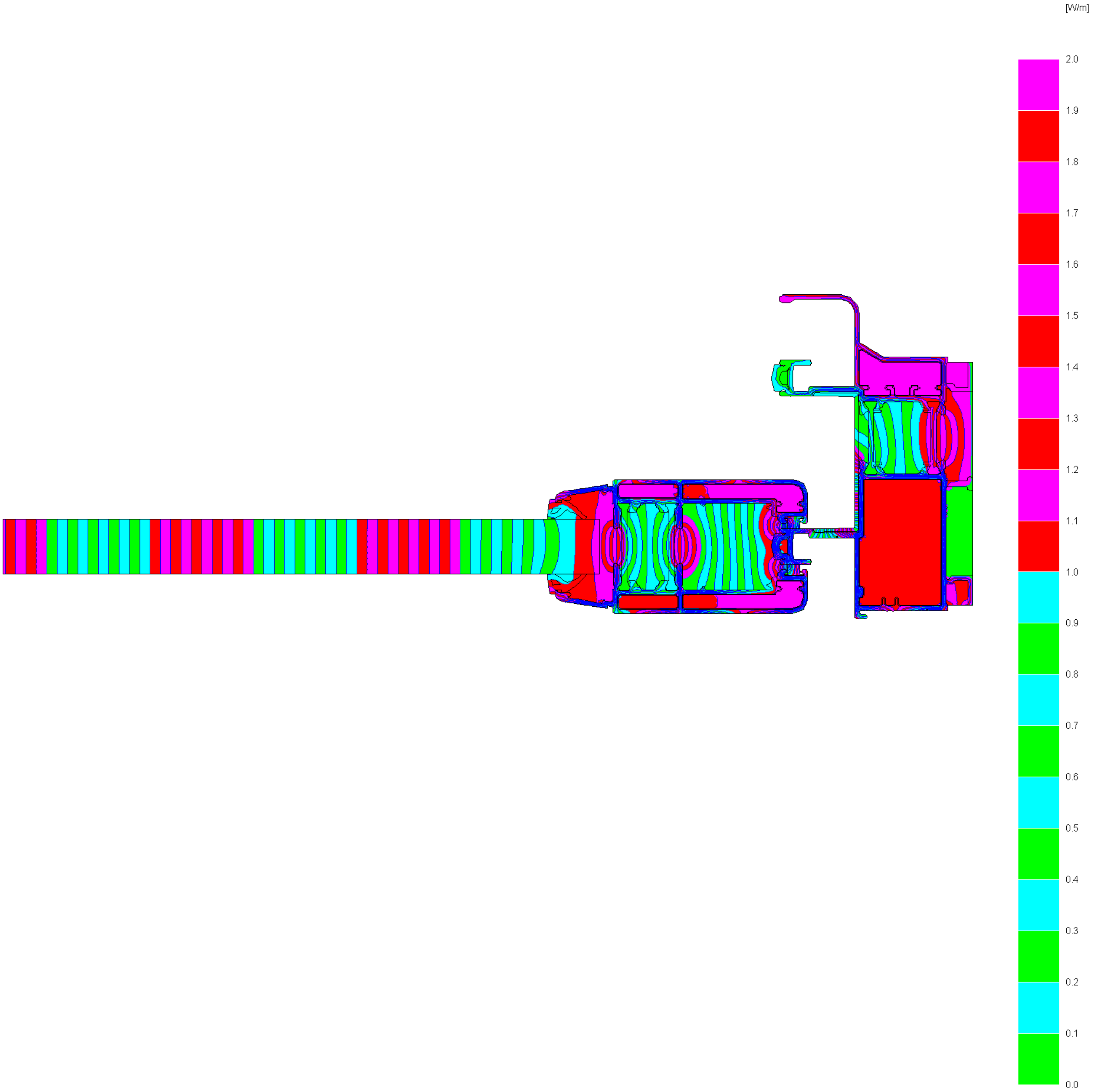
Isotermas



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	BC_FREE	CEN_VF_I	NO				
215	cavity	BC_FREE	CEN_VF_I	NO				
216	cavity	BC_FREE	CEN_VF_I	NO				
217	cavity	BC_FREE	CEN_VF_I	NO				
218	cavity	EQUIMAT	CEN_VF_I	NO	0.064	0.90		
219	cavity	EQUIMAT	CEN_VF_I	NO	0.053	0.90		
220	cavity	EQUIMAT	CEN_VF_I	NO	0.118	0.90		
221	cavity	EQUIMAT	CEN_VF_I	NO	0.050	0.90		
222	cavity	EQUIMAT	CEN_VF_I	NO	0.043	0.90		
223	cavity	EQUIMAT	CEN_VF_I	NO	0.105	0.90		
224	cavity	EQUIMAT	CEN_VF_I	NO	0.040	0.90		
225	cavity	EQUIMAT	CEN_VF_I	NO	0.104	0.90		
240	cavity	EQUIMAT	CEN_VF_E	NO	0.098	0.90		
242	cavity	EQUIMAT	CEN_VF_E	NO	0.092	0.90		
247	cavity <7x7 mm2	MATERIAL			0.046	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	2.50		20.0			
182	0	20.0	2.88		20.0			
190	0	20.0	3.22		20.0			

214	0	1.59	0	0.0249	0.58	0.25
215	0	1.95	0	0.0245	0.58	0.25
216	0	1.17	0	0.0249	0.58	0.25
217	0	2.07	0	0.0245	0.58	0.25
218				0.0242	0.58	0.25
219				0.0252	0.58	0.25
220				0.0248	0.58	0.333333
221				0.0244	0.58	0.25
222				0.0252	0.58	0.25
223				0.0248	0.58	0.333333
224				0.0244	0.58	0.25
225				0.0248	0.58	0.333333
240				0.025	0.58	0.25
242				0.0242	0.58	0.25
247						
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	0.62	13.03			
24	aluminium epsil	MATERIAL	0.67	12.98			
28	insulation	MATERIAL	1.68	16.30			
44	polyamid reinf.	MATERIAL	0.70	12.95			
60	EPDM	MATERIAL	2.73	13.81			
67	PVC flexible	MATERIAL	0.66	8.81			
119	temp. sensor 1	MATERIAL	9.08	9.08			
135	temp. sensor 2	MATERIAL	8.82	8.82			
151	temp. sensor 3	MATERIAL	12.97	12.97			
156	insulation far	MATERIAL	1.68	16.40			
167	temp. sensor 4	MATERIAL	13.02	13.02			
170	exterior	BC_SKY	0.49	8.81		0.10	18.32
174	interior 1	BC_SKY	13.77	16.40		5.12	0.00
182	interior 2	BC_SKY	12.90	13.77		5.36	0.00
190	interior 3	BC_SKY	8.81	12.90		7.73	0.00
214	cavity	BC_FREE	8.78	9.03	8.90	0.01	0.01
215	cavity	BC_FREE	0.73	8.79	4.67	0.54	0.54
216	cavity	BC_FREE	8.71	9.09	8.91	0.02	0.02
217	cavity	BC_FREE	0.72	8.75	4.61	0.85	0.85
218	cavity	EQUIMAT	0.67	0.73			
219	cavity	EQUIMAT	12.83	12.98			
220	cavity	EQUIMAT	3.65	12.92			
221	cavity	EQUIMAT	3.59	3.75			
222	cavity	EQUIMAT	12.92	12.98			
223	cavity	EQUIMAT	3.62	12.94			
224	cavity	EQUIMAT	3.59	3.64			
225	cavity	EQUIMAT	3.53	13.03			
240	cavity	EQUIMAT	9.02	10.98			
242	cavity	EQUIMAT	0.49	0.73			
247	cavity <7x7 mm2	MATERIAL	0.67	8.83			
250	cavity <4x4 mm2	MATERIAL	0.65	13.30			
251	cavity <3x3 mm2	MATERIAL	2.90	13.63			
252	cavity <2x2 mm2	MATERIAL	3.49	13.08			
253	cavity <1x1 mm2	MATERIAL	0.70	12.95			

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 (θi) and outside (θe) [K]

Calculation — Item:

input data:	$q_{l,tot}$ =	18,320	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} =	0,92	W/mK
	l_f =	0,1437	m		**U_f =**	**4,57**	**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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