Cálculo del coeficiente de transmisión térmica (Uf)

Ventana de Rebatir M-Tres (Lateral), con poliamida de 15 - Mediterránea RPT

Cliente: ***Alcemar***

Cálculos realizados por

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Resultados

Ventana de rebatir RTP M-3 mediante BISCO según norma EN ISO 10077-2:2003	**Uf = 4,12 W/m^{2}K**
Ventana de rebatir RTP M-3 mediante RADCON con "Know-How" TECHNOFORM	**Uf = 3,36 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.

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- Dibujo sistema

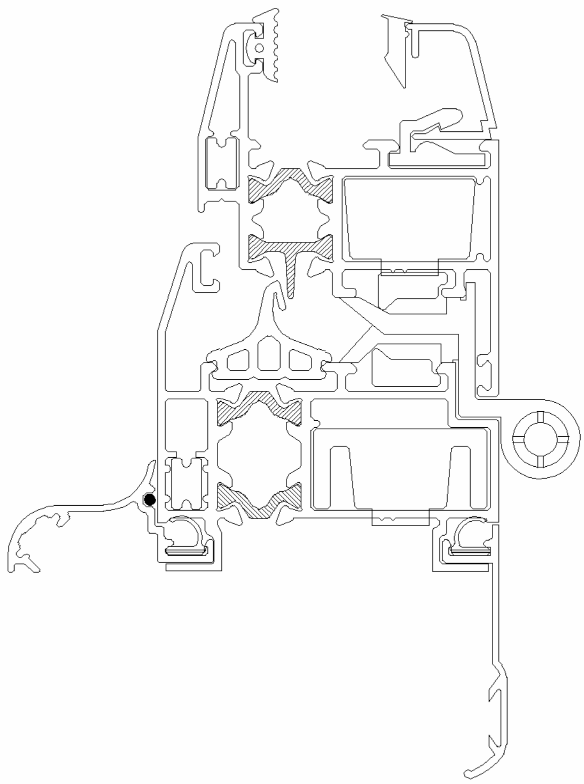
A) mediante BISCO según norma EN ISO 10077-2:2003

- 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			
28	insulation	MATERIAL			0.035			
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			
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	0.131			
215	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.048			
216	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.060			
217	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.106			
218	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.175			
219	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.054			
220	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.094			
221	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.042			
222	cavity (CEN)	EQUIMAT	CEN_VF_I	NO	0.111			
240	cavity (CEN)	EQUIMAT	CEN_VF_E	NO	0.093			
241	cavity (CEN)	EQUIMAT	CEN_VF_E	NO	0.098			
242	cavity (CEN)	EQUIMAT	CEN_VF_E	NO	0.086			
243	cavity (CEN)	EQUIMAT	CEN_VF_E	NO	0.087			
247	cavity <7x7 mm2	MATERIAL			0.046			
248	cavity <6x6 mm2	MATERIAL			0.043			
249	cavity <5x5 mm2	MATERIAL			0.040			
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								
28								
44								
60								
119								
135								
151								
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
247								
248								
249								
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	2.66	11.20			
28	insulation	MATERIAL	1.10	16.21			
44	polyamid reinf.	MATERIAL	2.76	10.81			
60	EPDM	MATERIAL	2.23	12.14			
119	temp. sensor 1	MATERIAL	9.44	9.44			
135	temp. sensor 2	MATERIAL	11.05	11.05			
151	temp. sensor 3	MATERIAL	13.89	13.89			
170	exterior	BC_SIMPL	1.10	3.44		0.00	13.47
174	interior (norma	BC_SIMPL	9.42	16.21		12.41	0.00
182	interior (reduc	BC_SIMPL	11.18	15.40		1.07	0.00
214	cavity (CEN)	EQUIMAT	2.77	9.40			
215	cavity (CEN)	EQUIMAT	2.71	2.77			
216	cavity (CEN)	EQUIMAT	2.77	9.25			
217	cavity (CEN)	EQUIMAT	9.25	9.44			
218	cavity (CEN)	EQUIMAT	2.67	11.02			
219	cavity (CEN)	EQUIMAT	3.49	10.80			
220	cavity (CEN)	EQUIMAT	10.79	11.03			
221	cavity (CEN)	EQUIMAT	3.37	3.47			
222	cavity (CEN)	EQUIMAT	3.41	11.99			
240	cavity (CEN)	EQUIMAT	1.57	2.78			
241	cavity (CEN)	EQUIMAT	9.39	11.29			
242	cavity (CEN)	EQUIMAT	9.40	11.48			
243	cavity (CEN)	EQUIMAT	1.94	3.51			
247	cavity <7x7 mm2	MATERIAL	2.76	9.29			
248	cavity <6x6 mm2	MATERIAL	10.88	11.08			
249	cavity <5x5 mm2	MATERIAL	5.09	7.41			
250	cavity <4x4 mm2	MATERIAL	3.22	10.98			
251	cavity <3x3 mm2	MATERIAL	3.37	3.41			
252	cavity <2x2 mm2	MATERIAL	3.40	11.08			
253	cavity <1x1 mm2	MATERIAL	2.59	11.36			

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:

$$U_f = \frac{L_{2D} - U_p * l_p}{l_f}$$

and

$$L_{2D} = \frac{q_{l,tot}}{\Delta\theta}$$

with:

- U_f : thermal transmittance of the window frame [W/m^2K]
- U_p : thermal transmittance of the flanking panel [W/m^2K]
- 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:	$q_{l,tot}$ =	13,470	W/m	R_{se} =	0,04	m^2K/W
	θ_e =	0,0	°C	R_{si} =	0,13	m^2K/W
	θ_i =	20,0	°C			
	d_i =	0,0180	m			
	λ_i =	0,035	W/m*K			
	U_p =	1,461	W/m^2K			
	l_p =	0,190	m			
				calculation results: L_{2D} =	0,67	W/mK
	l_f =	0,0961	m	**U_f =**	**4,12**	**W/m^2K**

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^2K]
- 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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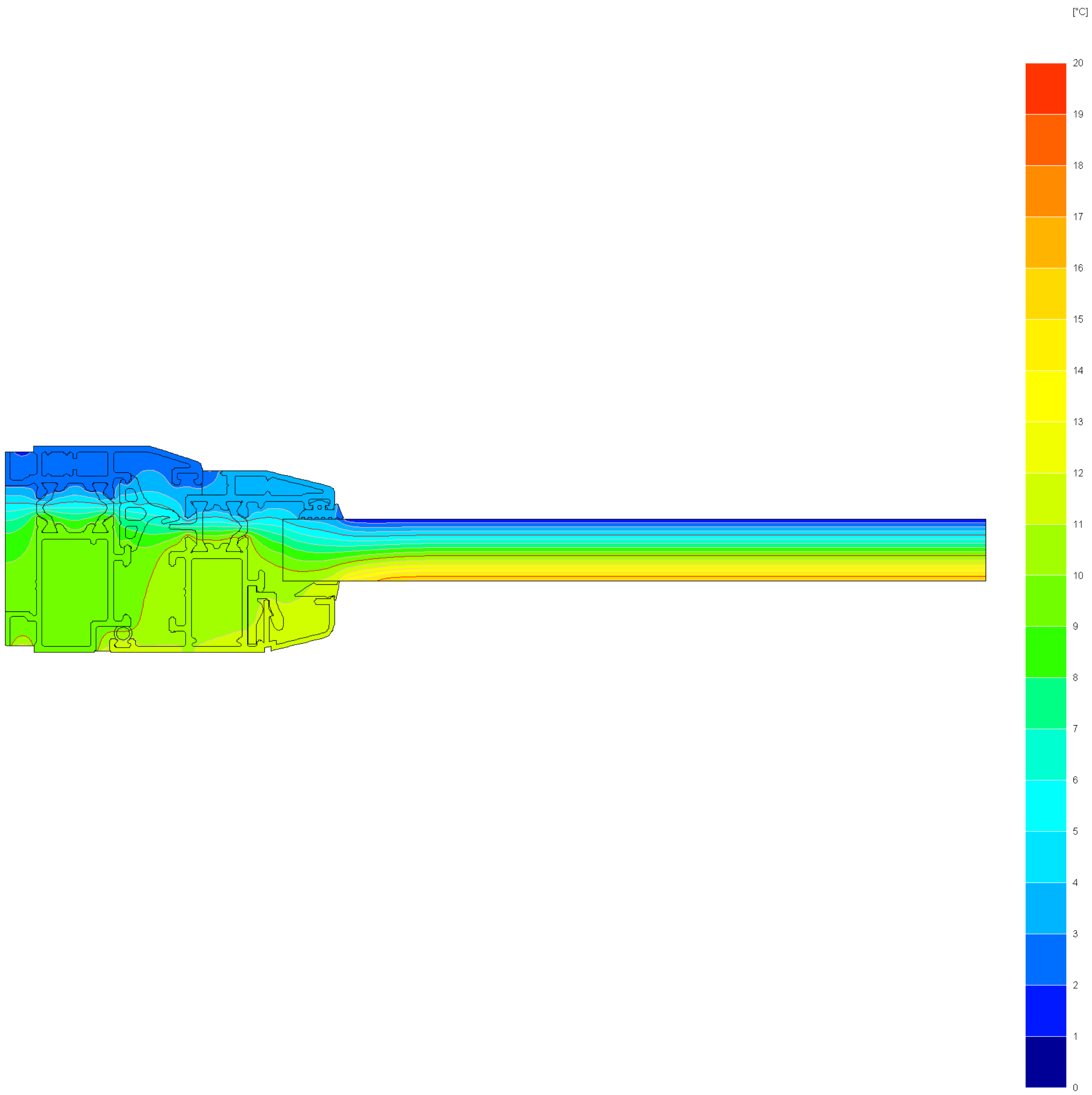
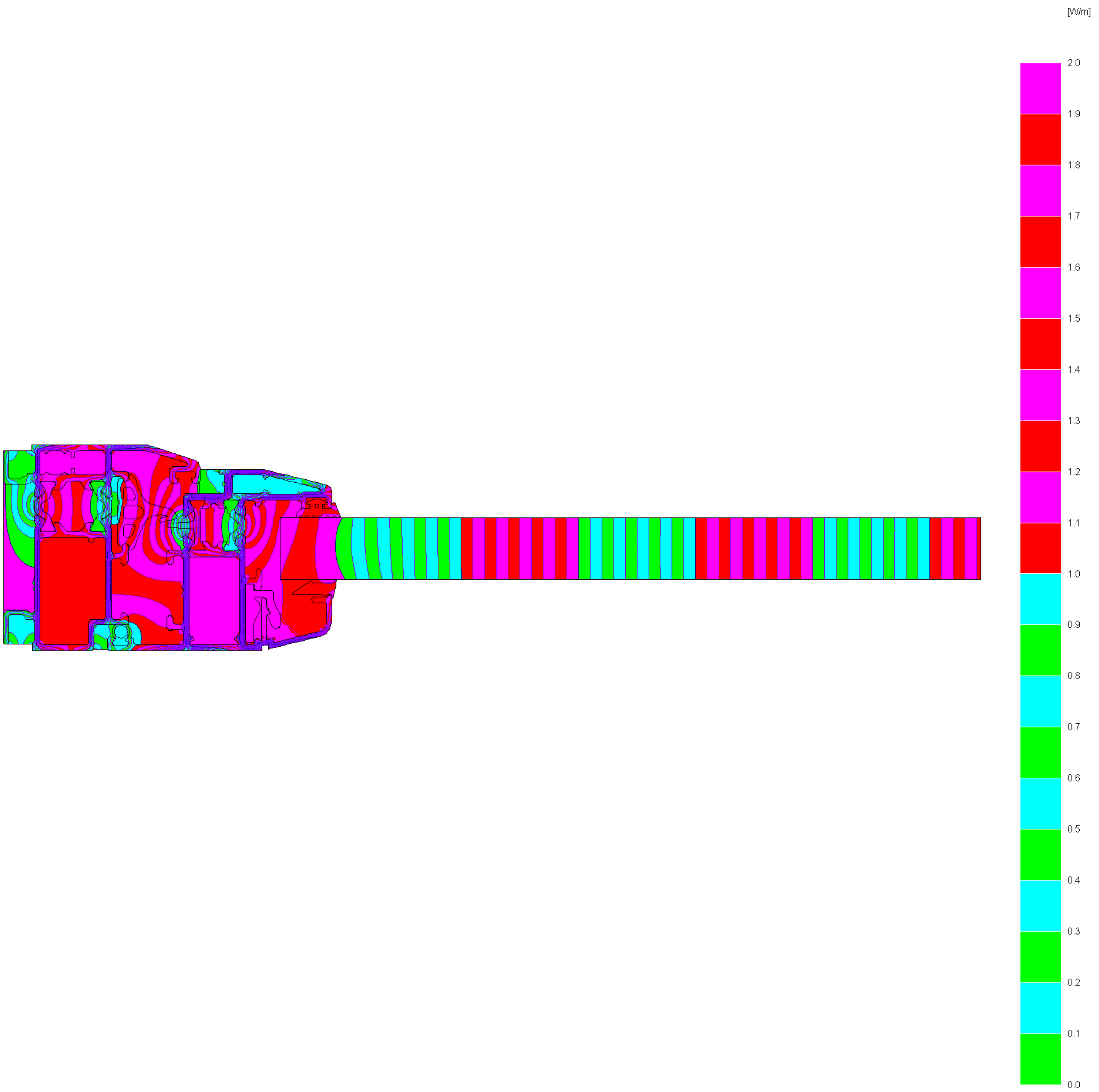
Isotermas



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^{2}K]
8	aluminium	MATERIAL			160.000	0.90		
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		
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	0.048	0.90		
216	cavity	EQUIMAT	CEN_VF_I	NO	0.060	0.90		
217	cavity	BC_FREE	CEN_VF_I	NO				
218	cavity	BC_FREE	CEN_VF_I	NO				
219	cavity	EQUIMAT	CEN_VF_I	NO	0.054	0.90		
220	cavity	BC_FREE	CEN_VF_I	NO				
221	cavity	EQUIMAT	CEN_VF_I	NO	0.042	0.90		
222	cavity	BC_FREE	CEN_VF_I	NO				
240	cavity	EQUIMAT	CEN_VF_E	NO	0.092	0.90		
241	cavity	EQUIMAT	CEN_VF_E	NO	0.099	0.90		
242	cavity	EQUIMAT	CEN_VF_E	NO	0.086	0.90		
243	cavity	EQUIMAT	CEN_VF_E	NO	0.087	0.90		
247	cavity <7x7 mm2	MATERIAL			0.046	0.90		
248	cavity <6x6 mm2	MATERIAL			0.043	0.90		
249	cavity <5x5 mm2	MATERIAL			0.040	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^{2}K]	qc [W/m]	tr [°C]	C1 [-]	C2 [-]	C3 [-]
8								
28								
44								
60								
100	0	20.0	3.07		20.0			
119								
135								
151								
156								
170	0	0.0	12.00		0.0			
174	0	20.0	2.50		20.0			

182	0	20.0	2.77		20.0			
190	0	20.0	3.19		20.0			
214	0		1.90	0		0.0246	0.58	0.25
215						0.0244	0.58	0.25
216						0.0246	0.58	0.25
217	0		1.65	0		0.0249	0.58	0.25
218	0		2.04	0		0.0247	0.58	0.25
219						0.0247	0.58	0.25
220	0		1.96	0		0.025	0.58	0.25
221						0.0244	0.58	0.25
222	0		2.04	0		0.0248	0.58	0.25
240						0.0243	0.58	0.25
241						0.025	0.58	0.25
242						0.025	0.58	0.25
243						0.0244	0.58	0.25
247								
248								
249								
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	3.67	13.28			
28	insulation	MATERIAL	1.75	15.75			
44	polyamid reinf.	MATERIAL	3.75	13.04			
60	EPDM	MATERIAL	3.07	13.65			
100	interior 4	BC_SKY	13.14	13.27		3.61	0.00
119	temp. sensor 1	MATERIAL	10.92	10.93			
135	temp. sensor 2	MATERIAL	13.18	13.18			
151	temp. sensor 3	MATERIAL	14.76	14.76			
156	insulation far	MATERIAL	1.73	16.27			
170	exterior	BC_SKY	1.73	3.96		0.00	11.86
174	interior 1	BC_SKY	15.75	16.27		4.92	0.00
182	interior 2	BC_SKY	13.27	15.75		1.08	0.00
190	interior 3	BC_SKY	10.91	13.38		2.26	0.00
214	cavity	BC_FREE	3.75	10.90	8.55	0.51	0.51
215	cavity	EQUIMAT	3.71	3.76			
216	cavity	EQUIMAT	3.76	10.77			
217	cavity	BC_FREE	10.77	10.93	10.85	0.01	0.01
218	cavity	BC_FREE	3.67	13.15	8.69	1.55	1.55
219	cavity	EQUIMAT	4.00	13.03			
220	cavity	BC_FREE	13.03	13.17	13.10	0.01	0.01
221	cavity	EQUIMAT	3.92	3.99			
222	cavity	BC_FREE	3.96	13.60	10.77	1.14	1.14
240	cavity	EQUIMAT	2.52	3.75			
241	cavity	EQUIMAT	10.89	12.53			
242	cavity	EQUIMAT	10.89	13.38			
243	cavity	EQUIMAT	2.80	4.07			
247	cavity <7x7 mm2	MATERIAL	3.76	10.79			
248	cavity <6x6 mm2	MATERIAL	13.08	13.20			
249	cavity <5x5 mm2	MATERIAL	6.76	8.93			
250	cavity <4x4 mm2	MATERIAL	4.37	13.07			
251	cavity <3x3 mm2	MATERIAL	3.93	3.96			
252	cavity <2x2 mm2	MATERIAL	3.97	13.20			
253	cavity <1x1 mm2	MATERIAL	3.35	13.40			

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:	$q_{l,tot}$ =	11,860	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 =	0,0180	m				
	λ_i =	0,035	W/m*K				
	U_p =	1,420	W/m²K				
	l_p =	0,190	m				
				calculation results:	L_{2D} =	0,59	W/mK
	l_f =	0,0961	m		**U_f =**	**3,36**	**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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