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EDIFICIOS PASIVOS



Informe de cálculo de la transmitancia térmica (U_{door}) de la
puerta de entrada:

PUERTA SUPER-CONFORT MADERA M-94

CLIENTE: Carpintería Llodiana S.A.

Barcelona, 20 de julio del 2016

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Se ha calculado la transmitancia térmica de la puerta de entrada según los criterios establecidos por el Passivhaus institut y siguiendo las indicaciones de cálculo de la normativa UNE 10077: 2.

Para el cálculo de la transmitancia térmica de la puerta de entrada se toma como medidas de la puerta de referencia de 1,10 x 2,20 m.

El cálculo de la transmitancia térmica de la puerta U_{Door} se realiza según la siguiente fórmula:

$$U_{Door} = \frac{A_{panel} \cdot U_{panel} + \sum A_{frame} \cdot U_{frame} + \sum l_{panel} \cdot \psi_{panel}}{A_{frame} + A_{panel}}$$

Dónde:

A_{panel} - superficie del panel opaco (m²)

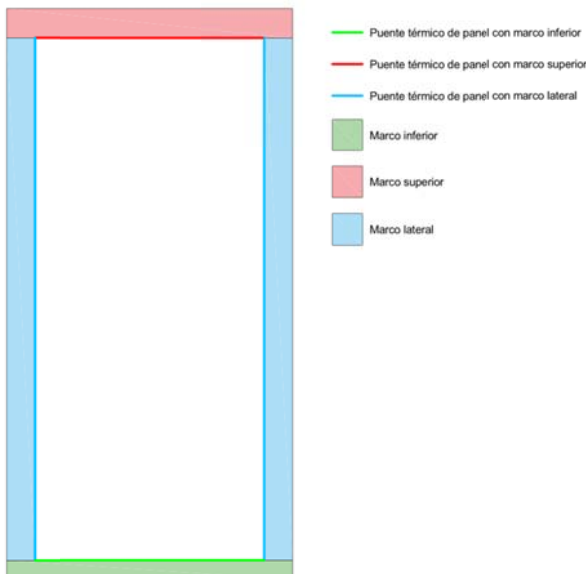
U_{panel} - transmitancia térmica del panel opaco (W/m²K)

A_{frame} - superficie del marco (m²)

U_{frame} - transmitancia térmica del marco (W/m²K)

l_{panel} - longitud del puente térmico de instalación del panel opaco con el marco

ψ_{panel} - puente térmico de instalación de la conexión del panel opaco con el marco



El resultado de la transmitancia térmica de la puerta obtenido mediante el cálculo es el siguiente:

$$U_{Door} = \frac{A_{panel} \cdot U_{panel} + \sum A_{frame} \cdot U_{frame} + \sum l_{panel} \cdot \psi_{panel}}{A_{frame} + A_{panel}}$$

dimensiones de la puerta estudiada

a 1,10 m

h 2,20 m

| | U_{frame} (W/m ² K) | A_{frame} (m ²) | U_{panel} (W/m ² K) | A_{panel} (m ²) | PSI_{panel} (W/mK) | l_{panel} (m) | U_{door} (W/m ² K) |
|----------|-------------------------------------|----------------------------------|-------------------------------------|----------------------------------|-------------------------|--------------------|------------------------------------|
| inferior | 1,64* | 0,083 | 0,409 | 1,779 | 0,00137* | 0,884 | 0,65 |
| superior | 1,26* | 0,123 | | | 0,00178* | 0,884 | |
| lateral | 1,28* | 0,435 | | | 0,00096* | 4,026 | |

$$U_{Door} = 0,65 \text{ W/m}^2\text{K}$$

*se adjunta anexo de cálculo de las transmitancias del marco y de los puentes térmicos de instalación del panel con el marco

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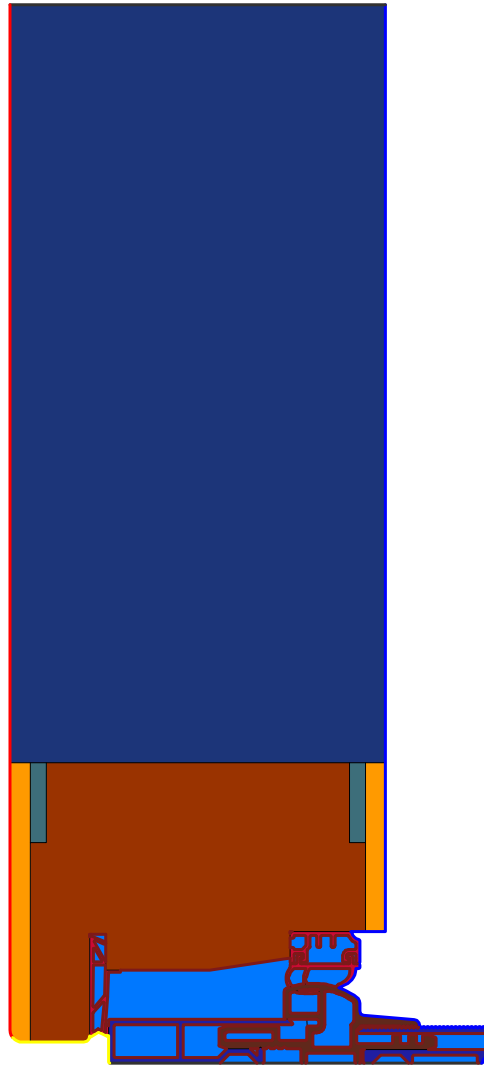
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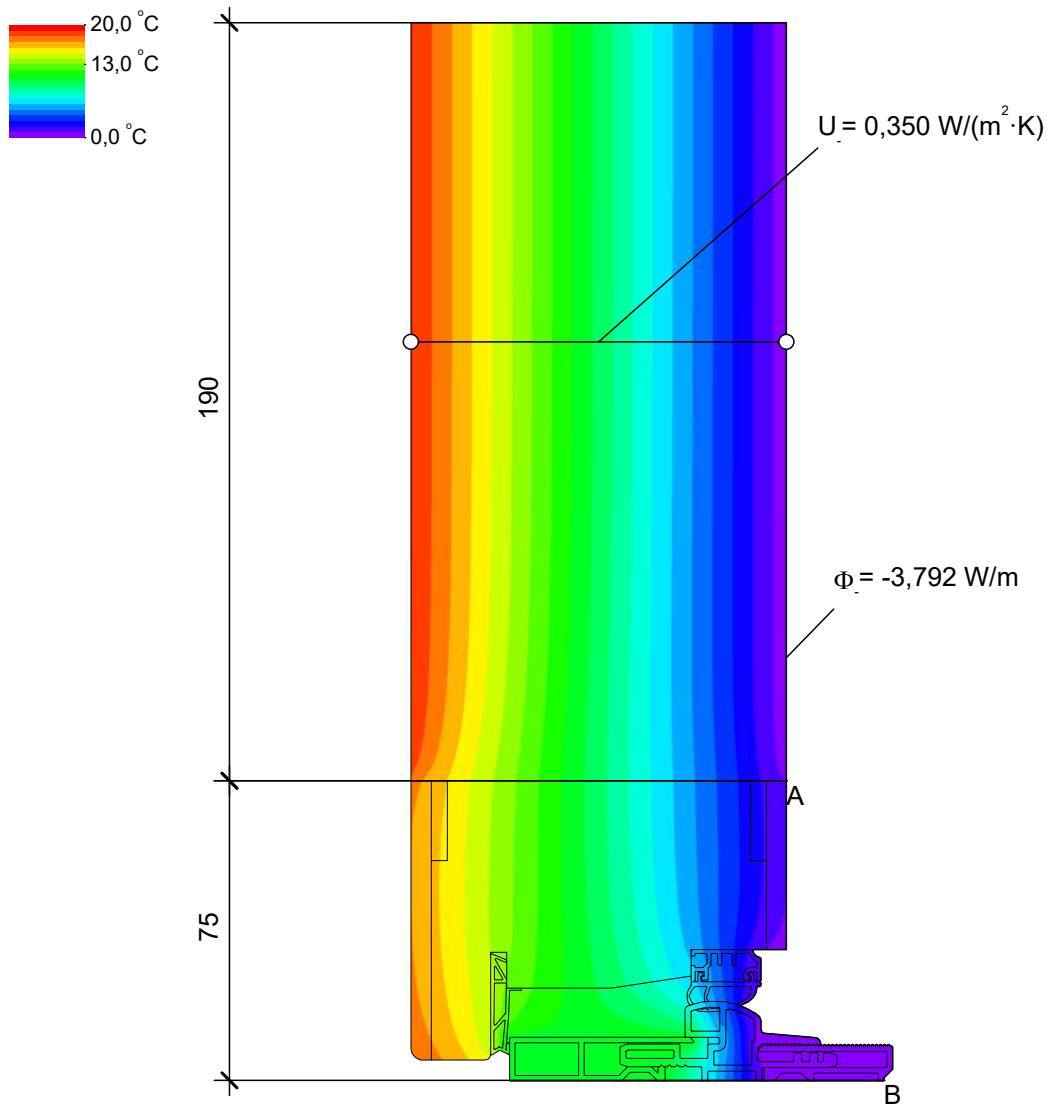
ANEXO DE CÁLCULO CON LA HERRAMIENTA FLIXO FRAME

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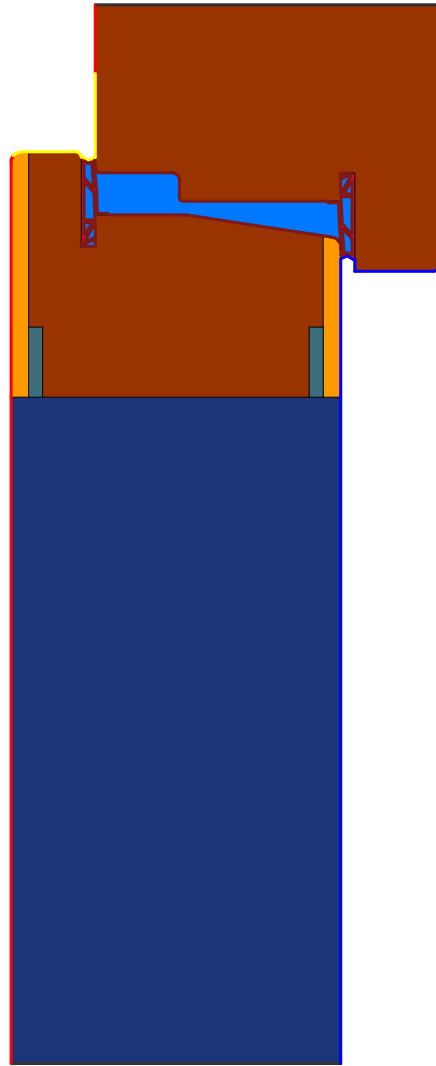
p.4



| Material | λ [W/(m·K)] | ϵ | Boundary Condition | q [W/m ²] | θ [°C] | R [(m ² ·K)/W] | ϵ |
|---|---------------------|------------|--------------------------|-------------------------|---------------|-----------------------------|------------|
| Aluminium (Si Alloys) | 160,000 | 0,900 | Epsilon 0.9 | | | | 0,900 |
| Contrachapado fenolítico | 0,170 | | Exterior, frame | 0,000 | | 0,040 | |
| EPDM (ethylene propylene diene monomer) | 0,250 | 0,900 | Interior, frame, normal | 20,000 | | 0,130 | |
| FIBRAN XPS 0.035 | 0,035 | | Interior, frame, reduced | 20,000 | | 0,200 | |
| Madera blanda | 0,150 | 0,900 | Symmetry/Model section | 0,000 | | | |
| PVC (polyvinylchloride), rigid | 0,170 | 0,900 | | | | | |
| Tablero DM | 0,180 | | | | | | |
| Unventilated air cavity | anisotropic | | | | | | |

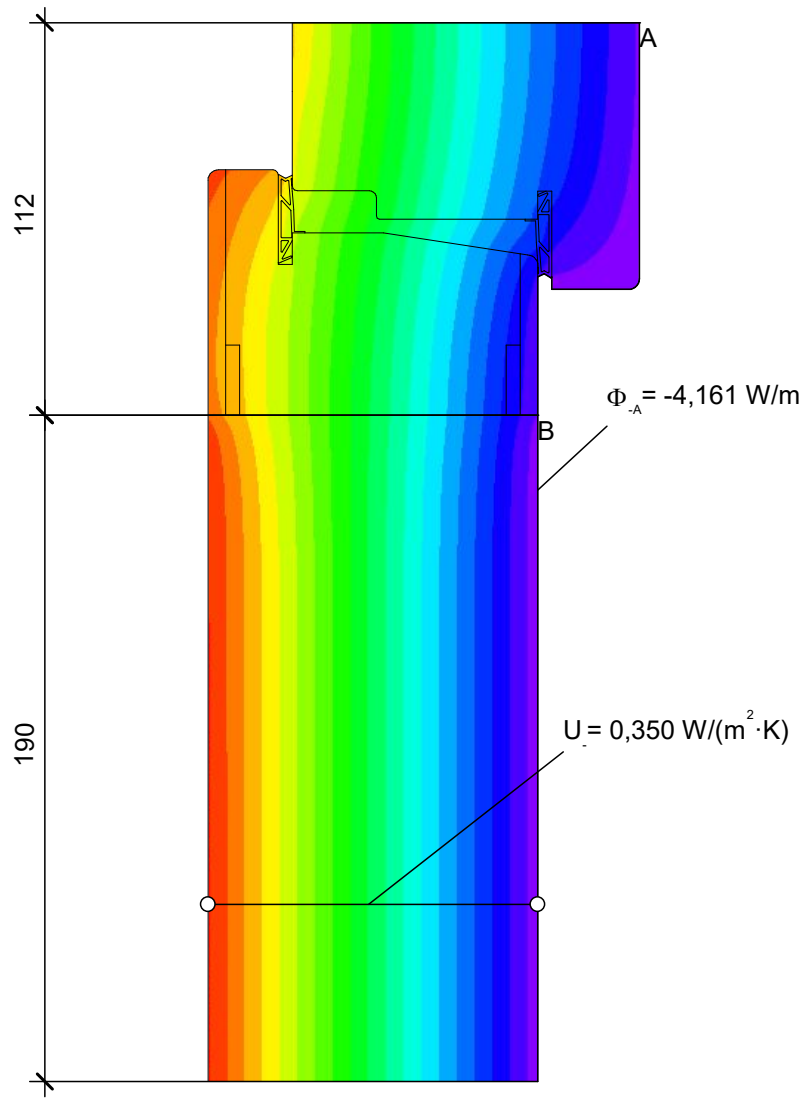
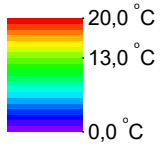


$$U_{f,A,B} = \frac{\frac{\Phi}{\Delta T} - U_p \cdot b_p}{b_f} = \frac{\frac{3,792}{20,000} - 0,350 \cdot 0,190}{0,075} = 1,64 \text{ W/(m}^2 \cdot \text{K)}$$

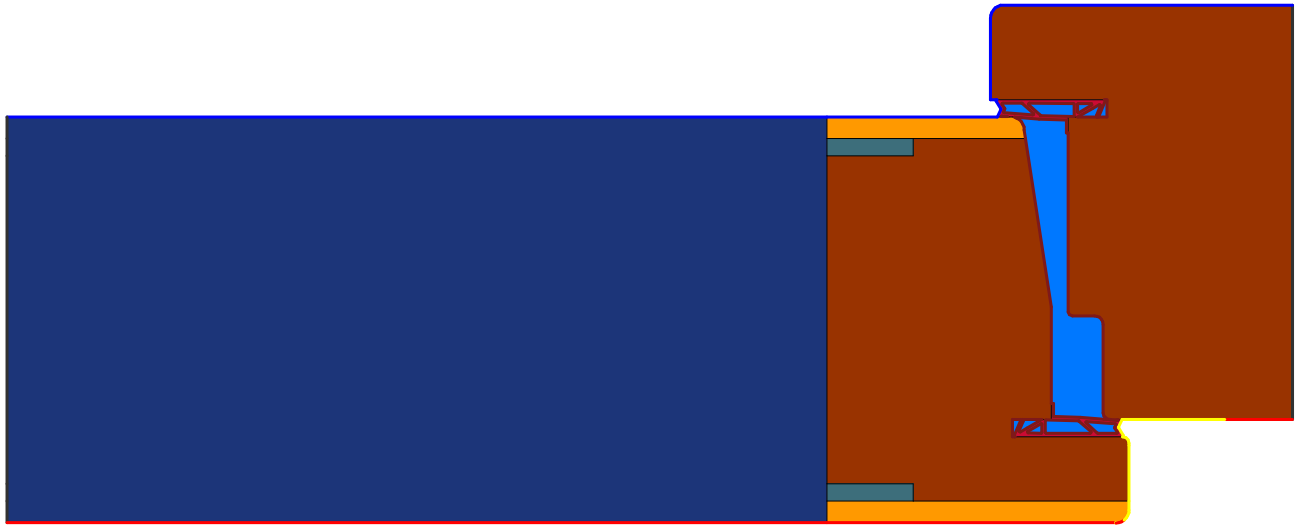


| Material | λ [W/(m·K)] | ϵ | Boundary Condition | q [W/m ²] | θ [°C] | R [(m ² ·K)/W] | ϵ |
|---|---------------------|------------|--------------------------|-------------------------|---------------|-----------------------------|------------|
| Contrachapado fenolítico | 0,170 | 0,900 | Epsilon 0.9 | | | | 0,900 |
| EPDM (ethylene propylene diene monomer) | 0,250 | 0,900 | Exterior, frame | 0,000 | | 0,040 | |
| FIBRAN XPS 0.035 | 0,035 | | Interior, frame, normal | 20,000 | | 0,130 | |
| Madera blanda | 0,150 | 0,900 | Interior, frame, reduced | 20,000 | | 0,200 | |
| Tablero DM | 0,180 | | Symmetry/Model section | 0,000 | | | |
| Unventilated air cavity | anisotropic | | | | | | |



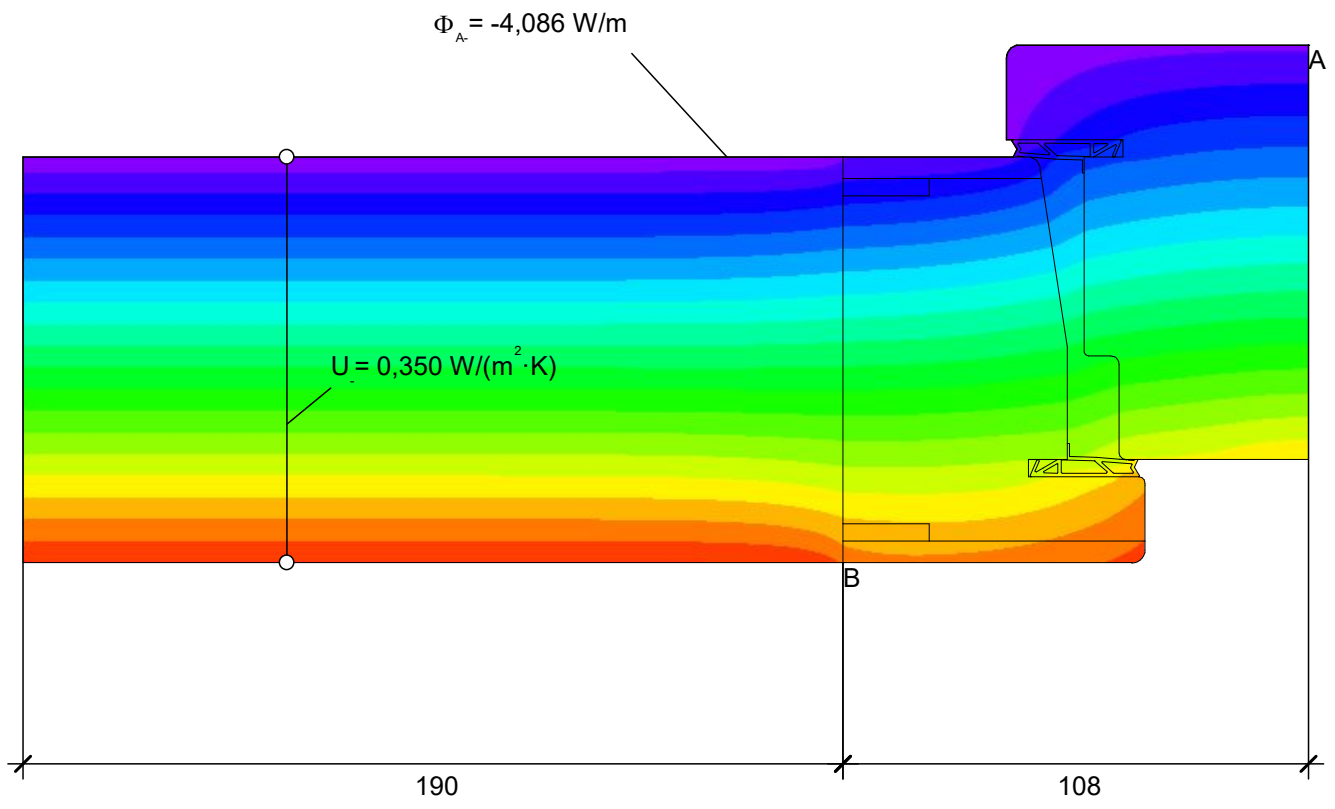
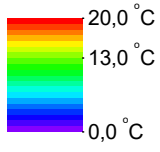


$$U_{fBA} = \frac{\frac{\Phi}{\Delta T} - U_p \cdot b_p}{b_f} = \frac{\frac{4,161}{20,000} - 0,350 \cdot 0,190}{0,112} = 1,26 \text{ W}/(\text{m}^2 \cdot \text{K})$$

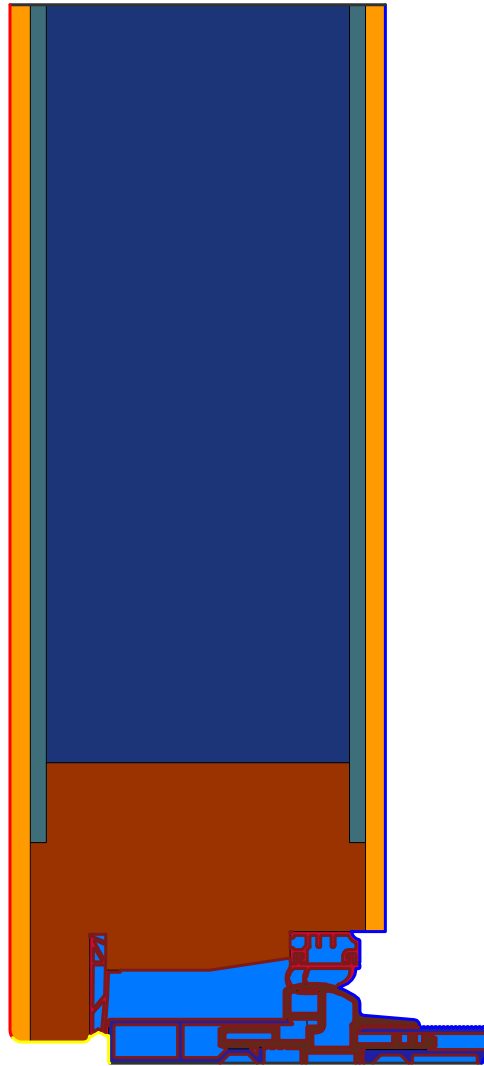


| Material | λ [W/(m·K)] | ϵ | Boundary Condition | q [W/m ²] | θ [°C] | R [(m ² ·K)/W] | ϵ |
|---|---------------------|------------|--------------------------|-------------------------|---------------|-----------------------------|------------|
| Contrachapado fenolítico | 0,170 | 0,900 | Epsilon 0.9 | | | | 0,900 |
| EPDM (ethylene propylene diene monomer) | 0,250 | 0,900 | Exterior, frame | 0,000 | 0,040 | | |
| FIBRAN XPS 0.035 | 0,035 | | Interior, frame, normal | 20,000 | 0,130 | | |
| Madera blanda | 0,150 | 0,900 | Interior, frame, reduced | 20,000 | 0,200 | | |
| Tablero DM | 0,180 | | Symmetry/Model section | 0,000 | | | |
| Unventilated air cavity | anisotropic | | | | | | |

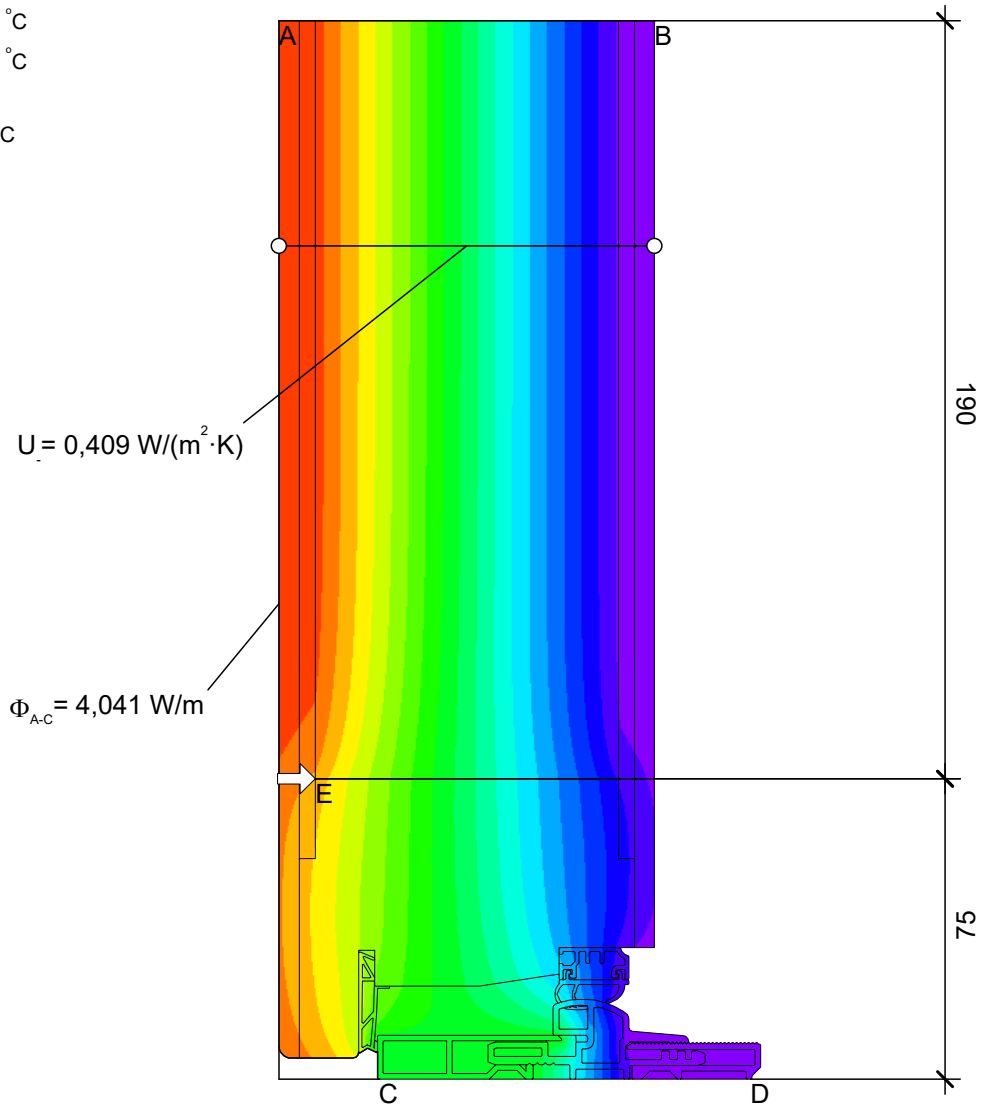
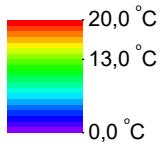




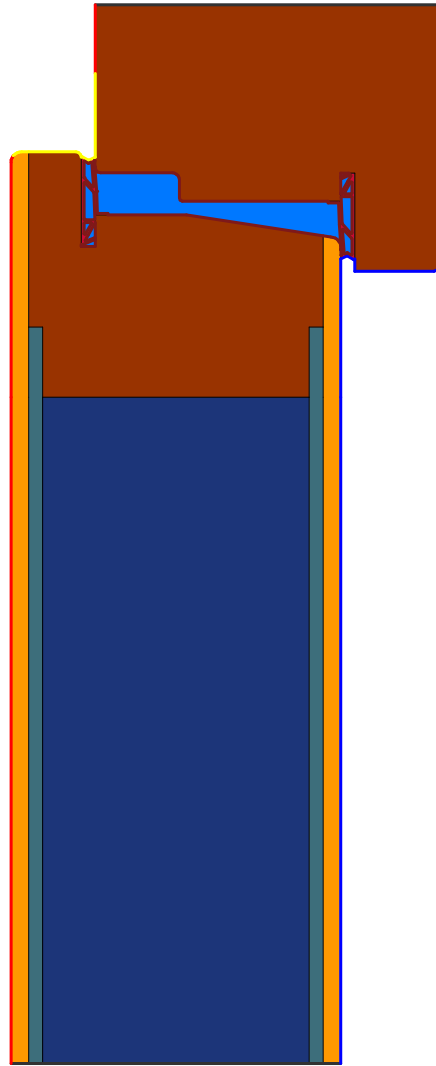
$$U_{fB,A} = \frac{\frac{\Phi}{\Delta T} - U_p \cdot b_p}{b_f} = \frac{\frac{4,086}{20,000} - 0,350 \cdot 0,190}{0,108} = 1,28 \text{ W/(m}^2 \cdot \text{K)}$$



| Material | λ [W/(m·K)] | ϵ | Boundary Condition | q [W/m ²] | θ [°C] | R [(m ² ·K)/W] | ϵ |
|---|---------------------|-------------|--------------------------|-------------------------|---------------|-----------------------------|------------|
| Aluminium (Si Alloys) | 160,000 | 0,900 | Epsilon 0.9 | | | | 0,900 |
| Contrachapado fenolítico | 0,170 | | Exterior, frame | 0,000 | | 0,040 | |
| EPDM (ethylene propylene diene monomer) | 0,250 | 0,900 | Interior, frame, normal | 20,000 | | 0,130 | |
| FIBRAN XPS 0.035 | 0,035 | | Interior, frame, reduced | 20,000 | | 0,200 | |
| Madera blanda | 0,150 | 0,900 | Symmetry/Model section | 0,000 | | | |
| PVC (polyvinylchloride), rigid | 0,170 | 0,900 | | | | | |
| Tablero DM | 0,180 | | | | | | |
| Unventilated air cavity | | anisotropic | | | | | |

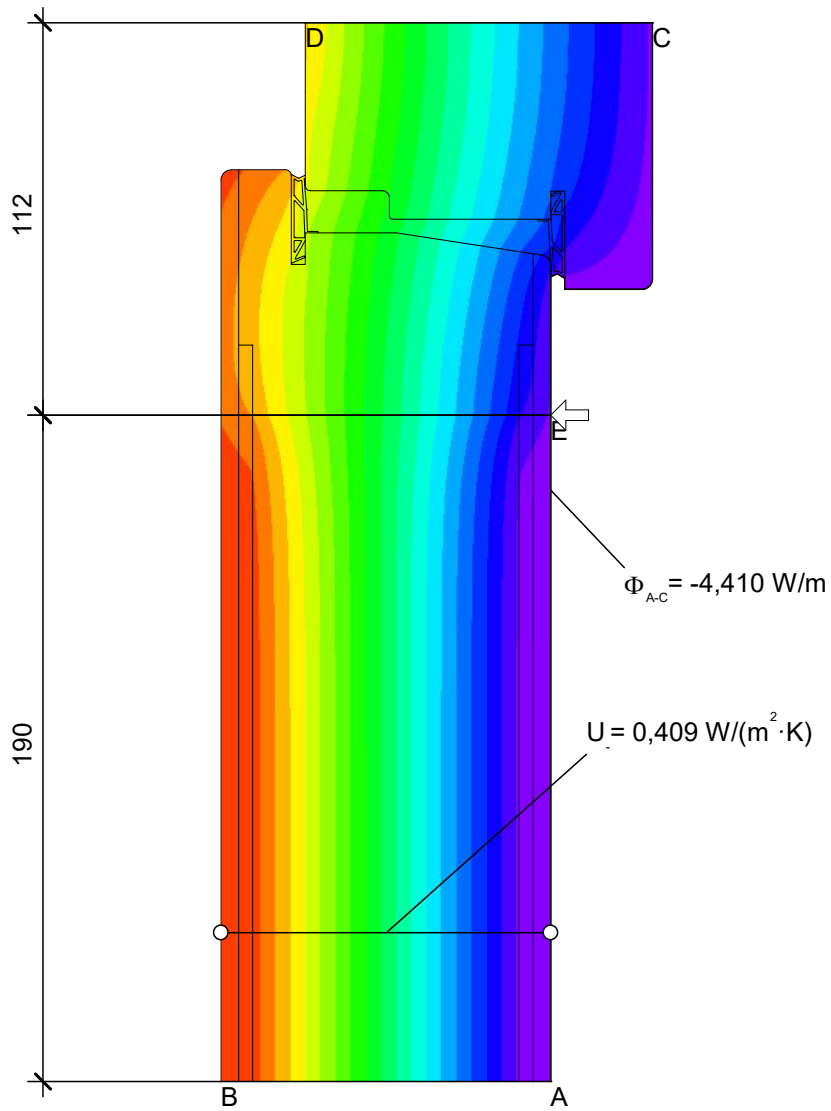
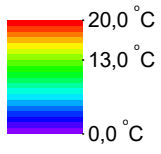


$$\Psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{4,041}{20,000} - 0,409 \cdot 0,190 - 1,640 \cdot 0,075 = 0,00137 \text{ W/(m}\cdot\text{K)}$$

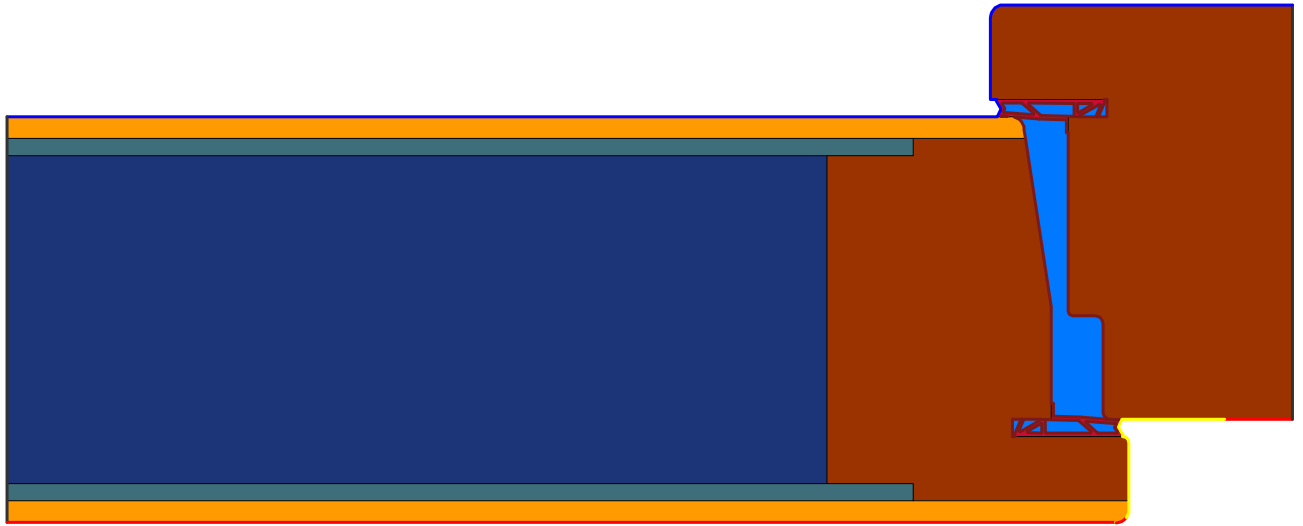


| Material | λ [W/(m·K)] | ϵ | Boundary Condition | q [W/m ²] | θ [°C] | R [(m ² ·K)/W] | ϵ |
|---|---------------------|------------|--------------------------|-------------------------|---------------|-----------------------------|------------|
| Contrachapado fenolítico | 0,170 | 0,900 | Epsilon 0.9 | | | | 0,900 |
| EPDM (ethylene propylene diene monomer) | 0,250 | 0,900 | Exterior, frame | 0,000 | | 0,040 | |
| FIBRAN XPS 0.035 | 0,035 | | Interior, frame, normal | 20,000 | | 0,130 | |
| Madera blanda | 0,150 | 0,900 | Interior, frame, reduced | 20,000 | | 0,200 | |
| Tablero DM | 0,180 | | Symmetry/Model section | 0,000 | | | |
| Unventilated air cavity | anisotropic | | | | | | |

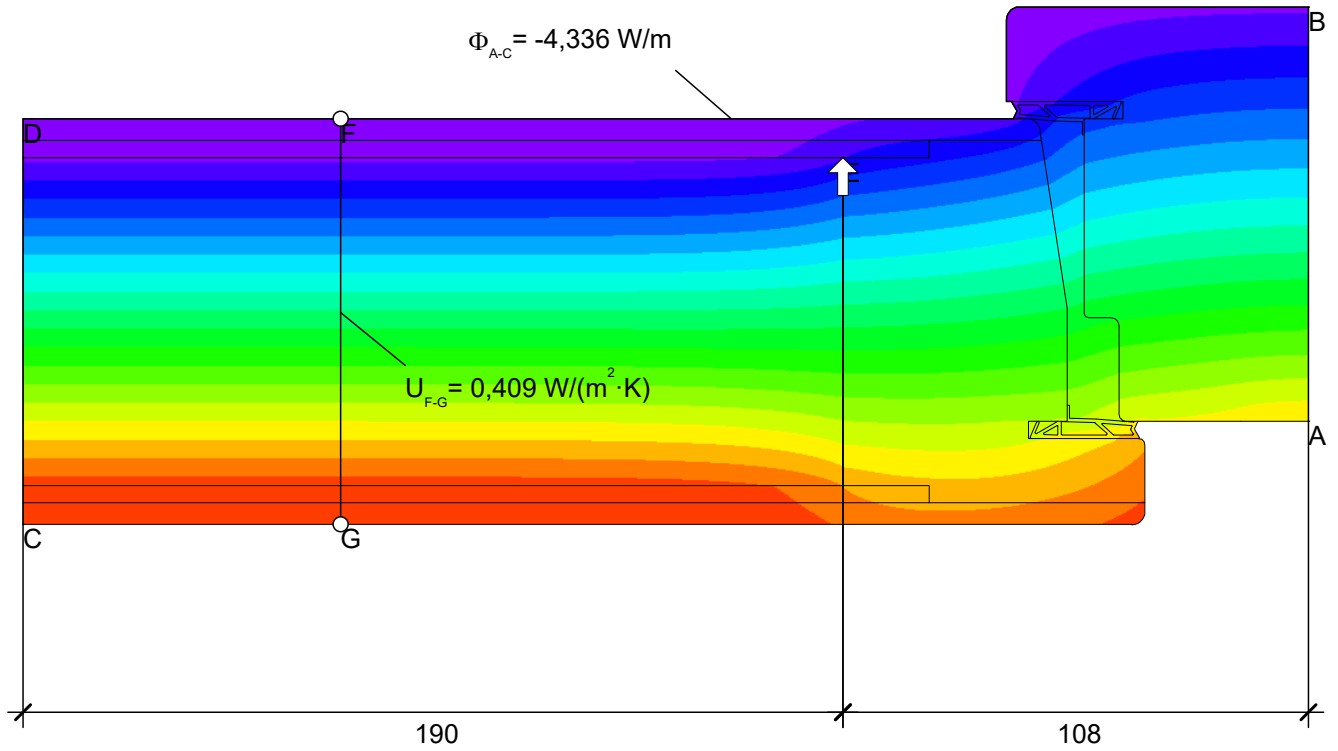
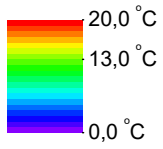




$$\Psi_{A-E-C, \dot{}} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{4,410}{20,000} - 0,409 \cdot 0,190 - 1,260 \cdot 0,112 = 0,00178 \text{ W/(m} \cdot \text{K)}$$



| Material | λ [W/(m·K)] | ϵ | Boundary Condition | q [W/m ²] | θ [°C] | R [(m ² ·K)/W] | ϵ |
|---|---------------------|------------|--------------------------|-------------------------|---------------|-----------------------------|------------|
| Contrachapado fenolítico | 0,170 | 0,900 | Epsilon 0.9 | | | | 0,900 |
| EPDM (ethylene propylene diene monomer) | 0,250 | 0,900 | Exterior, frame | | 0,000 | 0,040 | |
| FIBRAN XPS 0.035 | 0,035 | | Interior, frame, normal | | 20,000 | 0,130 | |
| Madera blanda | 0,150 | 0,900 | Interior, frame, reduced | | 20,000 | 0,200 | |
| Tablero DM | 0,180 | | Symmetry/Model section | 0,000 | | | |
| Unventilated air cavity | anisotropic | | | | | | |



$$\Psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{4,336}{20,000} - 1,280 \cdot 0,108 - 0,409 \cdot 0,190 = 0,00096 \text{ W/(m} \cdot \text{K)}$$