THERMOCHIP
HOUSING

THERMOCHIP
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warm, temperate climate

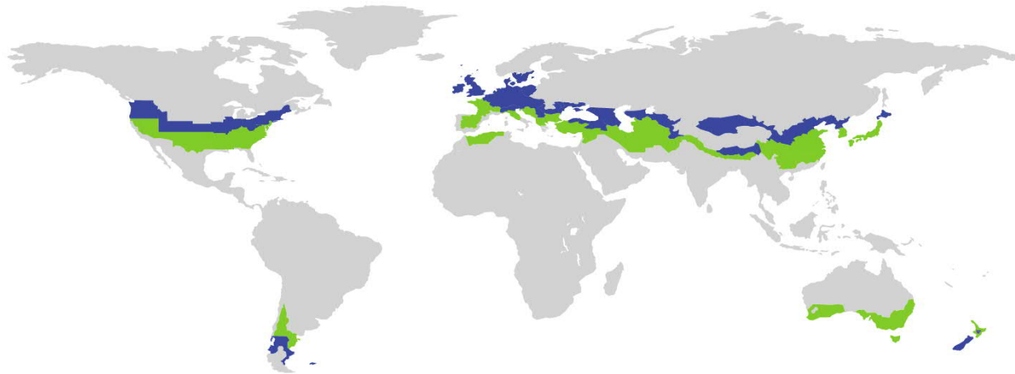
CERTIFIED COMPONENT
Passive House Institute

CERTIFICATE

Certified Passive House Component

ID: 1625cs04 valid until 31. December 2021

Passive House Institute
Dr. Wolfgang Feist
64342 Darmstadt
GERMANY



Category	**Construction system | Lightweight timber construction**
Manufacturer	**Thermochip SLU** **Carballeda de Valdeorras (Ourense)** **España**
Product name	**Thermochip HOUSING SATE-COAT**

This certificate for the warm, temperate climate zone was awarded based on the following criteria

Hygiene criterion

The minimum temperature factor of the interior surfaces is	$f_{Rsi=0,25m^2K/W} \geq$	**0.65**

Comfort criterion

The U-value of the installed windows is	$U_{W,i} \leq$	**1.05** W/(m²K)

Efficiency criteria

Heat transfer coefficient of building envelope	$U*f_{PHI} \leq$	**0.30** W/(m²K)
Temperature factor of opaque junctions	$f_{Rsi=0,25m^2K/W} \geq$	**0.82**
Thermal bridge-free design for key connection details	$\Psi \leq$	**0.01** W/(mK)

An airtightness concept for all components and connection details was provided

warm, temperate climate

CERTIFIED COMPONENT

Passive House Institute

Thermochip SLU
A Medua s/n 32330 Carballeda de Valdeorras (Ourense) España
Phone: | +34 988 33 55 85 | lfernandez@thermochip.com | www.thermochip.com

Opaque building envelope

With the Thermochip HOUSING Construction System the wintertime thermal insulation of buildings can be ensured. The system is constructed out of timber studs, beams and an outer sandwich panel. The sandwich panel (12/140/12 mm) comprises a board of fibre cement to the outside, a core of XPS (</=0,036 W/mK) and internal composite board with cellulose fibres. To the interior a service cavity provides a space for the building services and protects the airtightness layer.

The certification does not take into account point thermal bridges caused by structural columns or e.g. balcony connections, which must to be as-sessed separately. As investigated, the system is deemed suitable for passive houses in the warm-temperate climate zone, as the regular U-values of the exterior components are below 0,25 W/m²K and the connections meet the criteria of 'thermal bridge free'. The surface temperature of all con-nections (with the exception of window connec-tions) meet the hygiene requirements.

Windows

For the purposes of certification a standard passive house window (Uw = 1,00 W/m²K with Ug = 0,90 W/m²K) was used. The overall U-value of the in-stalled window of standard size (1,23 m wide by 1,48 m tall) should be no more than 0,05 W/m²K greater than the Uw to ensure occupant comfort - this criteria is met in this instance.

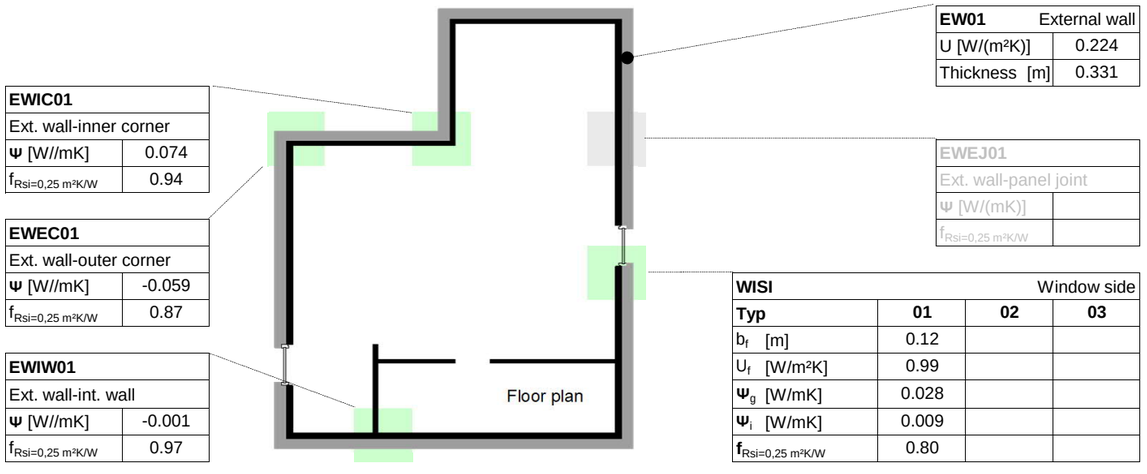
Airtightness concept

Airtightness of the system is achieved in the following way: windows and doors are installed with permanently elastic sealing materials and suitable airtight connection membranes and profiles. The airtight layer is located in the gypsum fibre board in the inner side of the sandwich panel. Joints between panels and connections with other building elements are sealed with Soudal Soudatight SP airtight paint.

Explanatory notes

The Passive House Institute has defined interna-tional component criteria for seven climate zones based on hygiene, comfort and affordability crite-ria. In principle, components which have been certified for climate zones with higher require-ments may also be used in climates with less strin-gent requirements. Their use might make econom-ic sense in certain circumstances.

Thermal bridge not calculated
Criteria achieved
Efficieny criteria not achieved
Hygiene or comfort criterion not achieved



EW01	External wall
U [W/(m²K)]	0.224
Thickness [m]	0.331

EWIC01	
Ext. wall-inner corner	
Ψ [W//mK]	0.074
$f_{Rsi=0,25\ m²K/W}$	0.94

EWJ01	
Ext. wall-panel joint	
Ψ [W/(mK)]	
$f_{Rsi=0,25\ m²K/W}$	

EWEC01	
Ext. wall-outer corner	
Ψ [W//mK]	-0.059
$f_{Rsi=0,25\ m²K/W}$	0.87

WISI			Window side
Typ	01	02	03
b_f [m]	0.12		
U_f [W/m²K]	0.99		
Ψ_g [W/mK]	0.028		
Ψ_i [W/mK]	0.009		
$f_{Rsi=0,25\ m²K/W}$	0.80		

EWIW01	
Ext. wall-int. wall	
Ψ [W//mK]	-0.001
$f_{Rsi=0,25\ m²K/W}$	0.97

ROVE01	
Verge	
Ψ [W//mK]	-0.049
$f_{Rsi=0,25\ m²K/W}$	0.88

ROIW01	
Roof-internal wall	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

RWSI01	
Roof window top	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

WITO			Window top
Typ	01	02	03
b_f [m]	0.12		
U_f [W/m²K]	0.99		
Ψ_g [W/mK]	0.028		
Ψ_i [W/mK]	0.005		
$f_{Rsi=0,25\ m²K/W}$	0.80		

EWCE01	
Ext. wall-ceiling	
Ψ [W//mK]	-0.006
$f_{Rsi=0,25\ m²K/W}$	0.96

RO01	Roof
U [W/(m²K)]	0.20
Thickness [m]	0.49

WIBO			Window bottom
b_f [m]	0.12		
U_f [W/m²K]	0.99		
Ψ_g [W/mK]	0.028		
Ψ_i [W/mK]	0.015		
$f_{Rsi=0,25\ m²K/W}$	0.79		
$U_{W,i}$ [W//m²K]	**1.03**		

WITH01	
Window threshold	
b_f [m]	0.145
U_f [W/m²K]	0.97
Ψ_e [W/mK]	0.027
Ψ_i [W/mK]	-0.017
$f_{Rsi=0,25\ m²K/W}$	0.76
$U_{W,i}$ [W//m²K]	**1.00**

FS01	Fl. slab
U [W/(m²K)]	0.21
Thickness [m]	0.70

BWBC01	Bsmnt w.-bsmnt c.
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

FSIW01	
Fl. slab-int. w.	
Ψ [W//mK]	0.001
$f_{Rsi=0,25\ m²K/W}$	0.83

Cross section

BWFS01	Bsmnt w.-fl. slab
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

FSBW01	Fl. slab-bsmnt w.
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

BW01	Basement wall
U [W/(m²K)]	
Thickness [m]	

FS02	Fl. slab	U [W/(m²K)]		Thickness [m]	

ROEA01	Eaves
Ψ [W//mK]	-0.022
$f_{Rsi=0,25\ m²K/W}$	0.90

RWBO01	Roof window bttm
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

RWTO01	Roof window side
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

RORI01	Ridge
Ψ [W//mK]	-0.015
$f_{Rsi=0,25\ m²K/W}$	0.94

FRAW01	
Flat roof-asc. wall	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

TC01	Cold roof
U [W/(m²K)]	
Thickness [m]	

ROJU01	Junction
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

FR01	Flat roof
U [W/(m²K)]	0.20
Thickness [m]	0.473

EO01	Overhang
U [W/(m²K)]	
Thickness [m]	

TCEA01	Cold roof-eaves
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

BC01	Basement ceiling
U [W/(m²K)]	
Thickness [m]	

EWEO01	Ext. wall-overhang
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

Longitudinal section

EWEO02	Ext. wall-overhang
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

BCEW01	Bsmnt clg-ext. wall
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

FRRP01	Roof parapet
Ψ [W//mK]	-0.039
$f_{Rsi=0,25\ m²K/W}$	0.87

FSEW01	Fl. slab-ext. wall
Ψ [W//mK]	-0.101
$f_{Rsi=0,25\ m²K/W}$	0.83

FSBW02	Fl. slab-bsmnt w.
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

BCIW01	Bsmnt clg-int. wall
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

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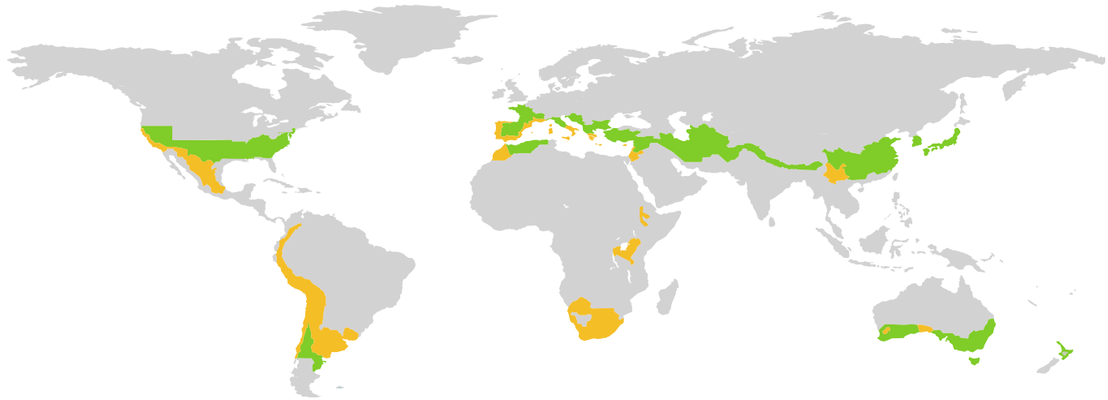

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The certification does not take into account point thermal bridges caused by structural columns or e.g. balcony connections, which must to be assessed separately. As investigated, the system is deemed suitable for passive houses in the warm-temperate climate zone, as the regular U-values of the exterior components are below 0,25 W/m²K and the connections meet the criteria of 'thermal bridge free'. The surface temperature of all connections meet the hygiene requirements.

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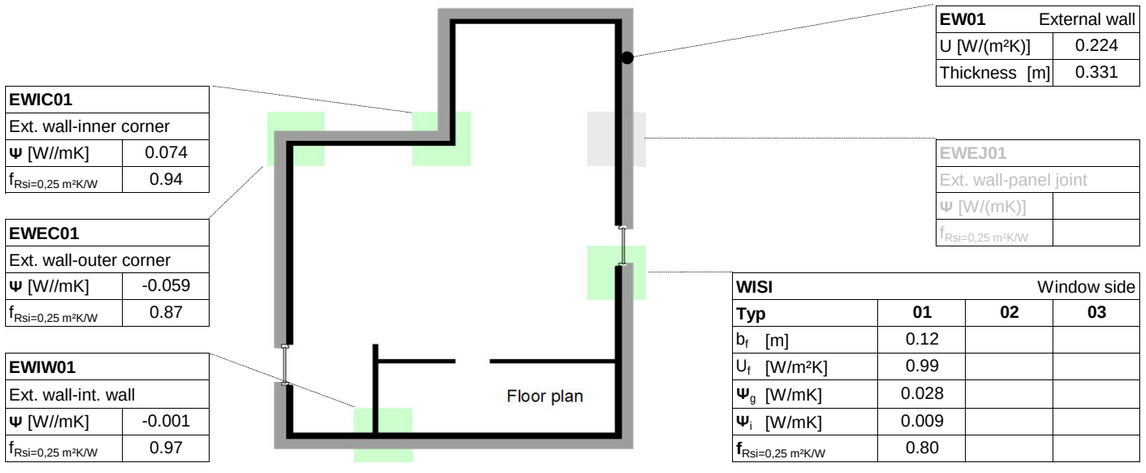
Criteria achieved
Efficieny criteria not achieved
Hygiene or comfort criterion not achieved



EWIC01	
Ext. wall-inner corner	
Ψ [W//mK]	0.074
$f_{Rsi=0,25\ m²K/W}$	0.94

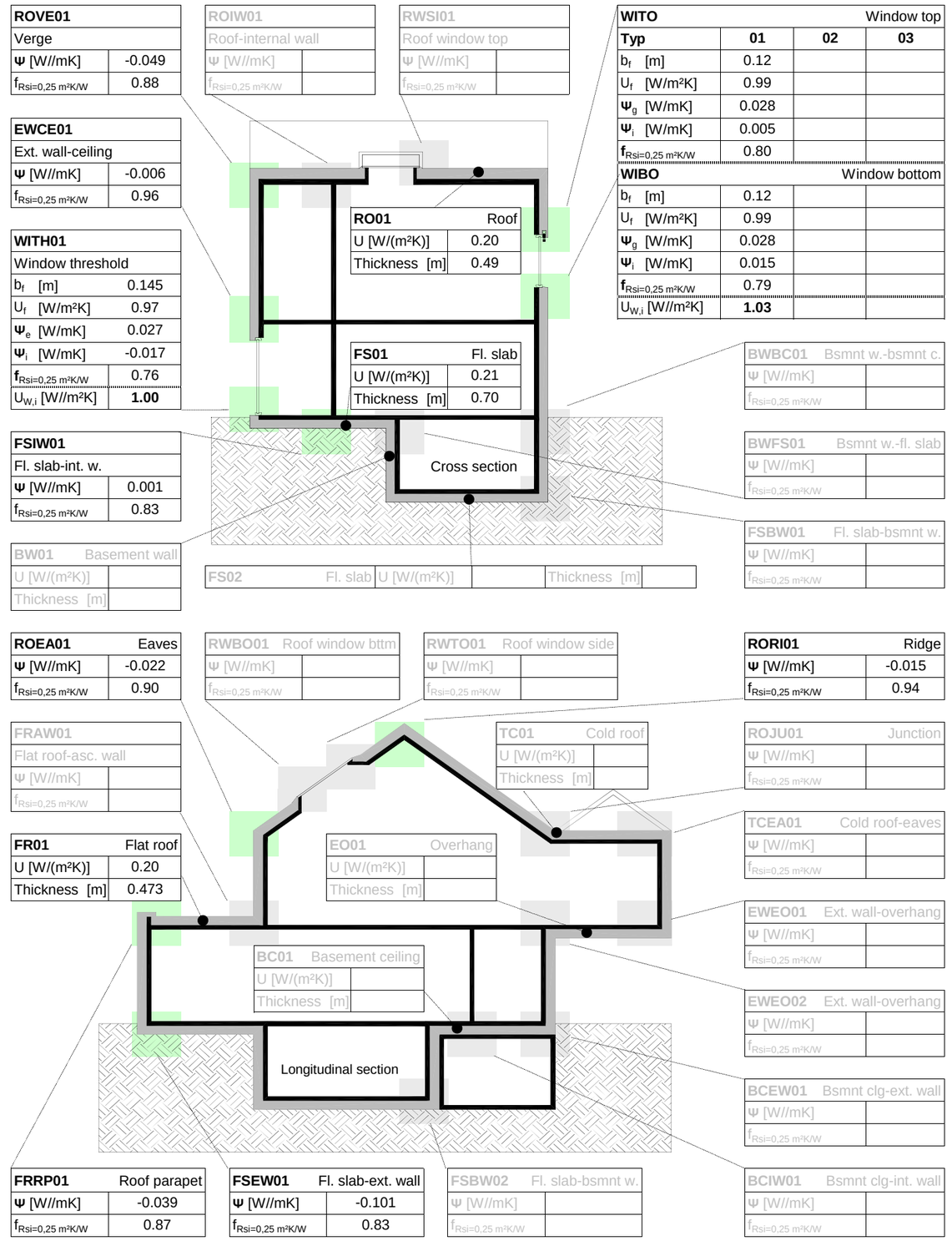
EWEC01	
Ext. wall-outer corner	
Ψ [W//mK]	-0.059
$f_{Rsi=0,25\ m²K/W}$	0.87

EWIW01	
Ext. wall-int. wall	
Ψ [W//mK]	-0.001
$f_{Rsi=0,25\ m²K/W}$	0.97

EW01	External wall
U [W/(m²K)]	0.224
Thickness [m]	0.331

EWEJ01	
Ext. wall-panel joint	
Ψ [W/(mK)]	
$f_{Rsi=0,25\ m²K/W}$	

WISI	Window side		
Typ	**01**	**02**	**03**
b_f [m]	0.12		
U_f [W/m²K]	0.99		
Ψ_g [W/mK]	0.028		
Ψ_i [W/mK]	0.009		
$f_{Rsi=0,25\ m²K/W}$	0.80		



ROVE01	
Verge	
Ψ [W//mK]	-0.049
$f_{Rsi=0,25\ m²K/W}$	0.88

ROIW01	
Roof-internal wall	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

RWSI01	
Roof window top	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

WITO	Window top		
Typ	**01**	**02**	**03**
b_f [m]	0.12		
U_f [W/m²K]	0.99		
Ψ_g [W/mK]	0.028		
Ψ_i [W/mK]	0.005		
$f_{Rsi=0,25\ m²K/W}$	0.80		

WIBO	Window bottom		
b_f [m]	0.12		
U_f [W/m²K]	0.99		
Ψ_g [W/mK]	0.028		
Ψ_i [W/mK]	0.015		
$f_{Rsi=0,25\ m²K/W}$	0.79		
$U_{W,i}$ [W//m²K]	**1.03**		

EWCE01	
Ext. wall-ceiling	
Ψ [W//mK]	-0.006
$f_{Rsi=0,25\ m²K/W}$	0.96

RO01	Roof
U [W/(m²K)]	0.20
Thickness [m]	0.49

WITH01	
Window threshold	
b_f [m]	0.145
U_f [W/m²K]	0.97
Ψ_e [W/mK]	0.027
Ψ_i [W/mK]	-0.017
$f_{Rsi=0,25\ m²K/W}$	0.76
$U_{W,i}$ [W//m²K]	**1.00**

FS01	Fl. slab
U [W/(m²K)]	0.21
Thickness [m]	0.70

BWBC01	Bsmnt w.-bsmnt c.
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

FSIW01	
Fl. slab-int. w.	
Ψ [W//mK]	0.001
$f_{Rsi=0,25\ m²K/W}$	0.83

BWFS01	Bsmnt w.-fl. slab
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

FSBW01	Fl. slab-bsmnt w.
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

BW01	Basement wall
U [W/(m²K)]	
Thickness [m]	

FS02	Fl. slab	U [W/(m²K)]		Thickness [m]	

ROEA01	Eaves
Ψ [W//mK]	-0.022
$f_{Rsi=0,25\ m²K/W}$	0.90

RWBO01	Roof window bttm
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

RWTO01	Roof window side
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

RORI01	Ridge
Ψ [W//mK]	-0.015
$f_{Rsi=0,25\ m²K/W}$	0.94

FRAW01	
Flat roof-asc. wall	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

TC01	Cold roof
U [W/(m²K)]	
Thickness [m]	

ROJU01	Junction
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

FR01	Flat roof
U [W/(m²K)]	0.20
Thickness [m]	0.473

EO01	Overhang
U [W/(m²K)]	
Thickness [m]	

TCEA01	Cold roof-eaves
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

EWEO01	Ext. wall-overhang
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

BC01	Basement ceiling
U [W/(m²K)]	
Thickness [m]	

EWEO02	Ext. wall-overhang
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

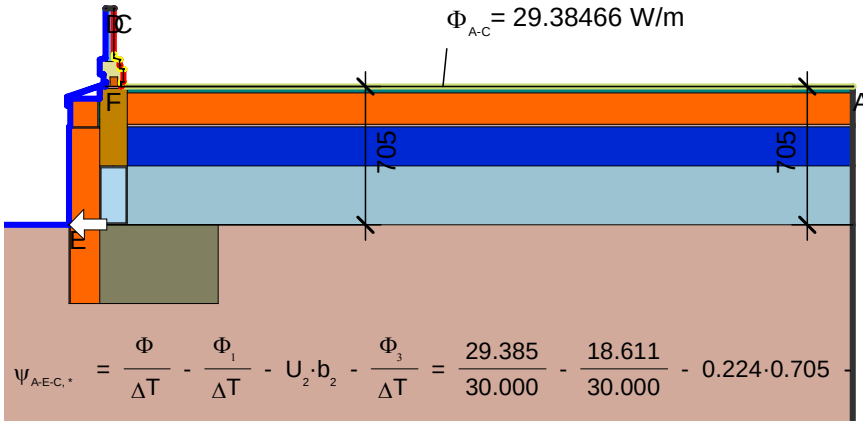
BCEW01	Bsmnt clg-ext. wall
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

FRRP01	Roof parapet
Ψ [W//mK]	-0.039
$f_{Rsi=0,25\ m²K/W}$	0.87

FSEW01	Fl. slab-ext. wall
Ψ [W//mK]	-0.101
$f_{Rsi=0,25\ m²K/W}$	0.83

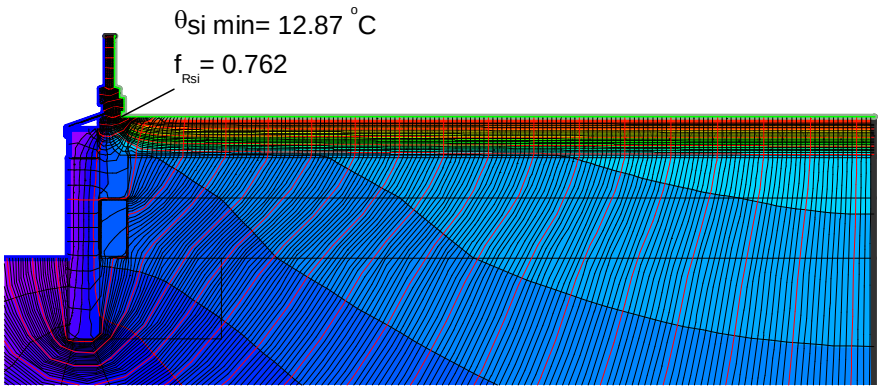
FSBW02	Fl. slab-bsmnt w.
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

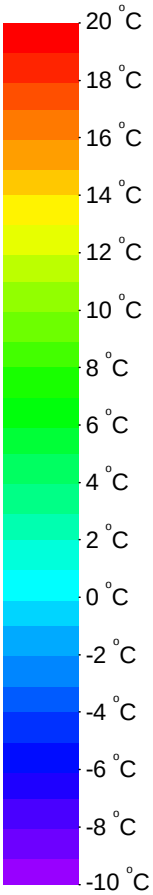
BCIW01	Bsmnt clg-int. wall
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

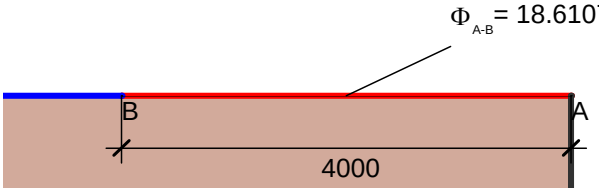


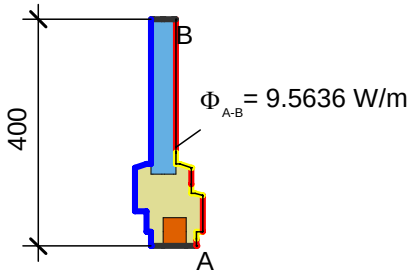
$$\psi_{A\text{-}E\text{-}C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_1}{\Delta T} - U_2 \cdot b_2 - \frac{\Phi_3}{\Delta T} = \frac{29.385}{30.000} - \frac{18.611}{30.000} - 0.224 \cdot 0.705 - \frac{9.564}{30.000} = -0.118 \text{ W/(m·K)}$$

$\Psi_{WITH} = \Psi_{FSEW+WITH} - \Psi_{FSEW01} = -0.118 - (-0.101) = -0.017$ W/mK

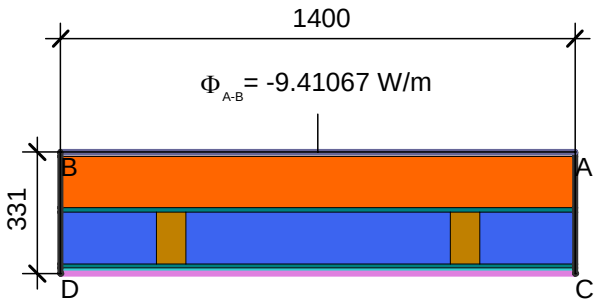








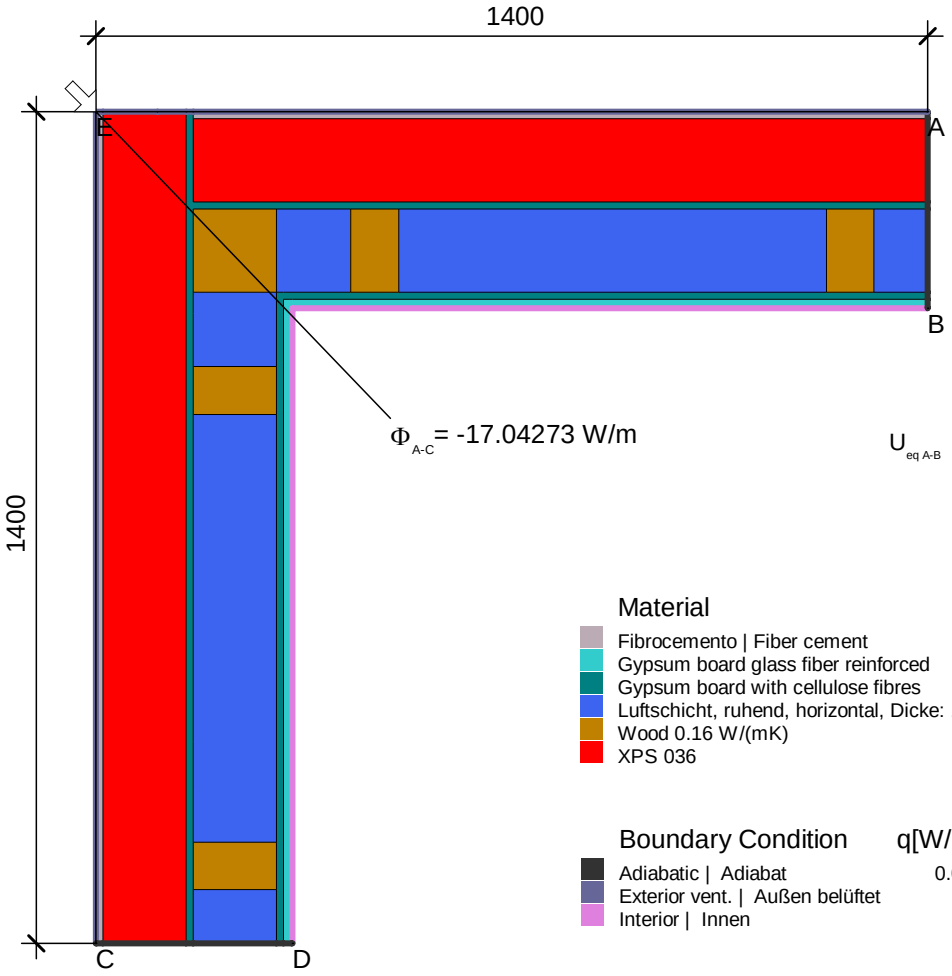
Material	λ[W/(m·K)]	ε
Aluminum I Aluminium 10456	160.000	0.900
Concrete, 1% Steel I Beton, 1% Stahl ISO 10456	2.300	0.900
EPDM	0.250	0.900
Fibrocemento | Fiber cement	1.200	0.900
Ground I Erdreich	2.000	0.900
Gypsum board with cellulose fibres	0.669	0.900
Insulation I Wärmedämmung 050	0.050	0.900
Luftschicht, ruhend, horizontal, Dicke: 280 mm	1.556	0.900
Luftschicht, schwach belüftet, aufwärts, Dicke: 200 mm	2.500	0.900
Luftschicht, schwach belüftet, aufwärts, Dicke: 300 mm	3.750	0.900
PU in-situ foam I PU-Ortschaum 040	0.040	0.900
Panel I Maske	0.035	0.900
Softwood, OSB I Weichholz, OSB ISO 10456	0.130	0.900
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900

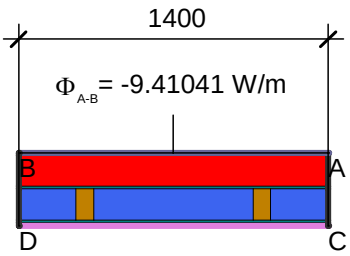


Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior | Außen		-10.000	0.040	
Int. flux down I Innen abwärts		20.000	0.170	
Interior, frame, normal		20.000	0.130	
Interior, frame, reduced		20.000	0.200	

$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.411}{30.000 \cdot 1.400} = 0.224 \text{ W/(m}^2\text{·K)}$$

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior | Außen		-10.000	0.040	
fRsi: Interior I Innen		20.000	0.250	



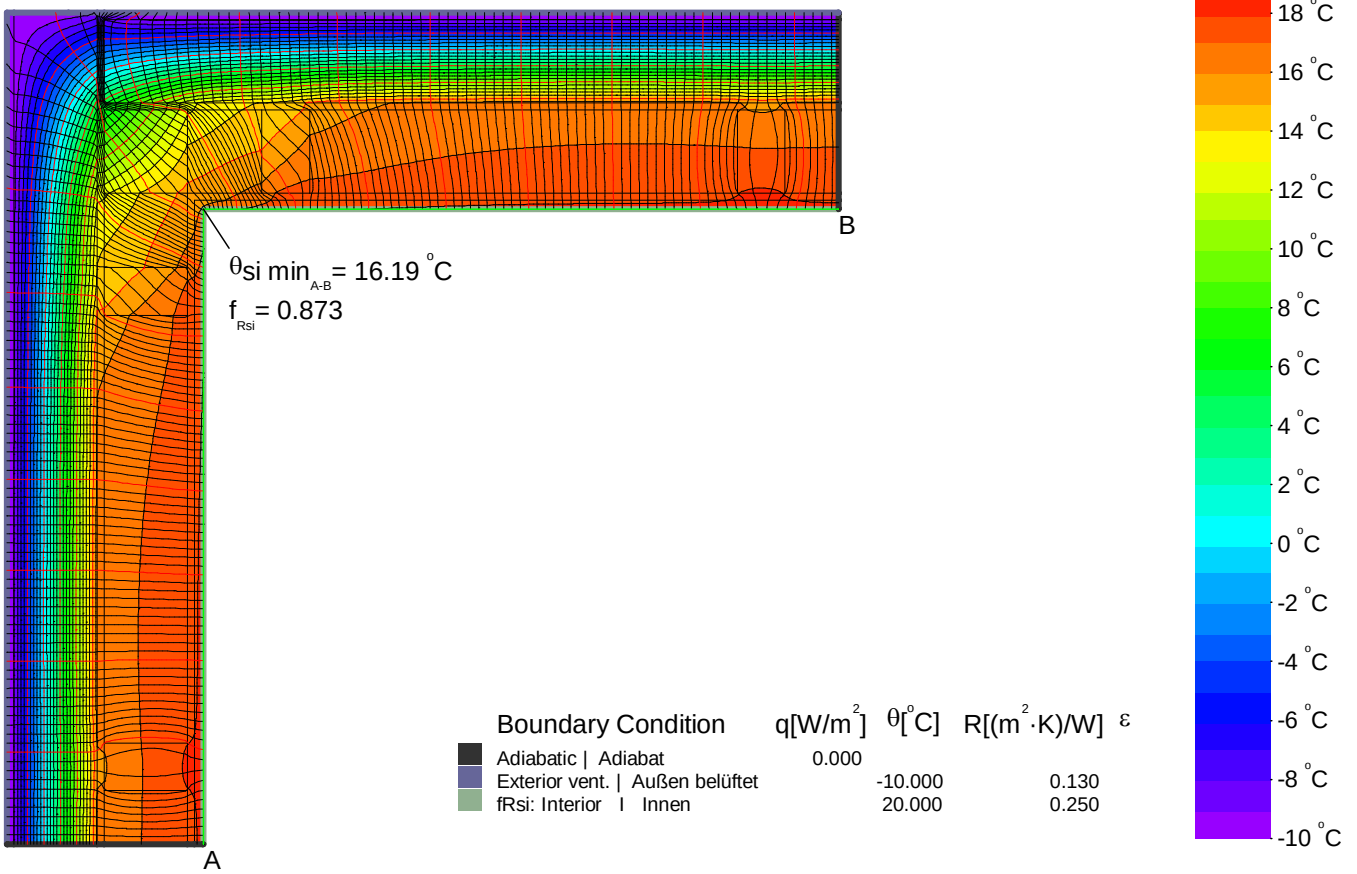


$$U_{eq\ A-B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.410}{30.000 \cdot 1.400} = 0.224\ W/(m^2 \cdot K)$$

Material	λ[W/(m·K)]	ε
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Luftschicht, ruhend, horizontal, Dicke: 140 mm (1)	0.778	0.900
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Interior | Innen		20.000	0.130	

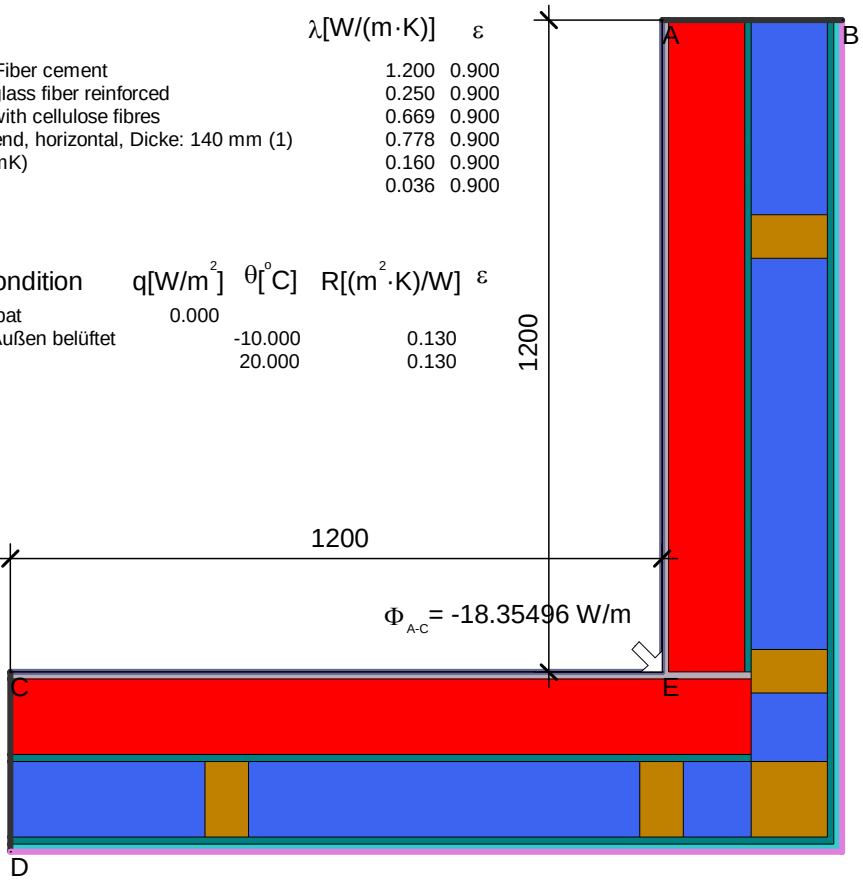
$$\psi_{A-E-C,\,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{17.043}{30.000} - 0.224 \cdot 1.400 - 0.224 \cdot 1.400 = -0.059\ W/(m \cdot K)$$



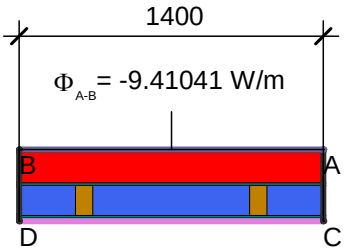
Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
fRsi: Interior I Innen		20.000	0.250	

Material	λ[W/(m·K)]	ε
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Luftschicht, ruhend, horizontal, Dicke: 140 mm (1)	0.778	0.900
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Interior | Innen		20.000	0.130	

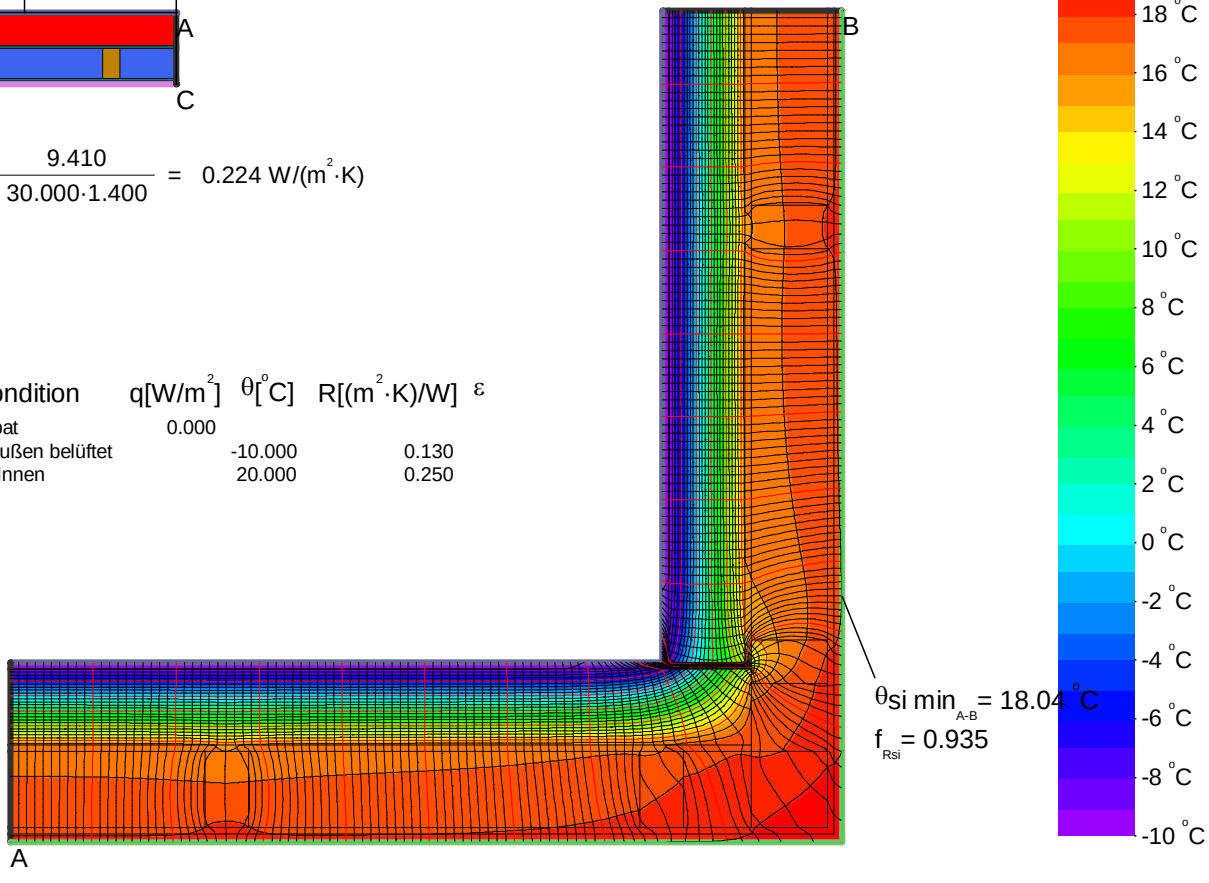


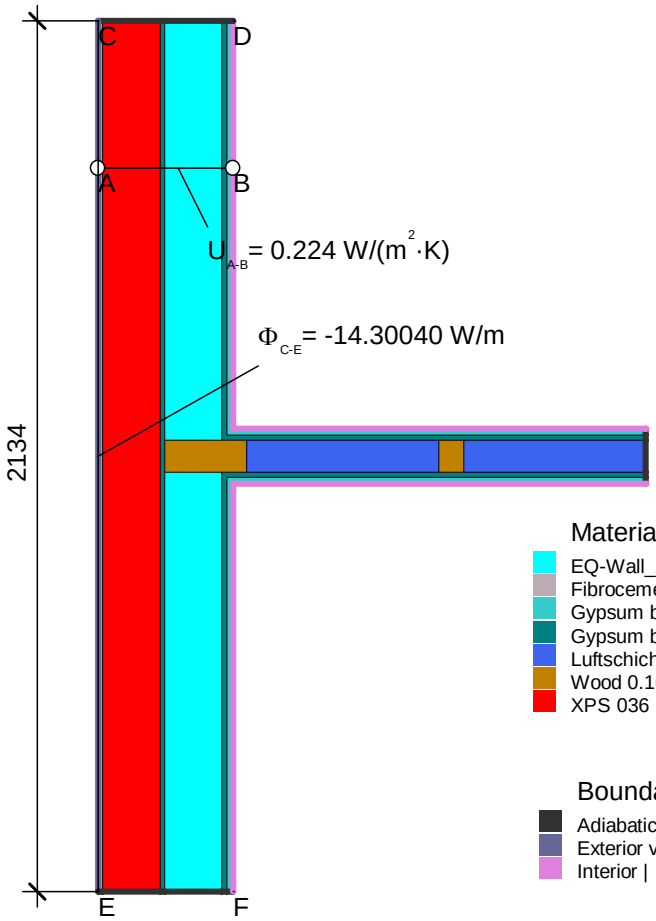
$$\psi_{A\text{-}E\text{-}C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{18.355}{30.000} - 0.224 \cdot 1.200 - 0.224 \cdot 1.200 = 0.074 \text{ W/(m·K)}$$

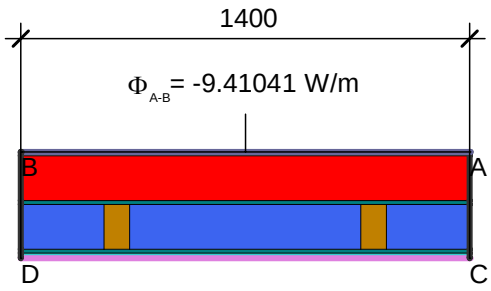


$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.410}{30.000 \cdot 1.400} = 0.224 \text{ W/(m²·K)}$$

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
fRsi: Interior I Innen		20.000	0.250	





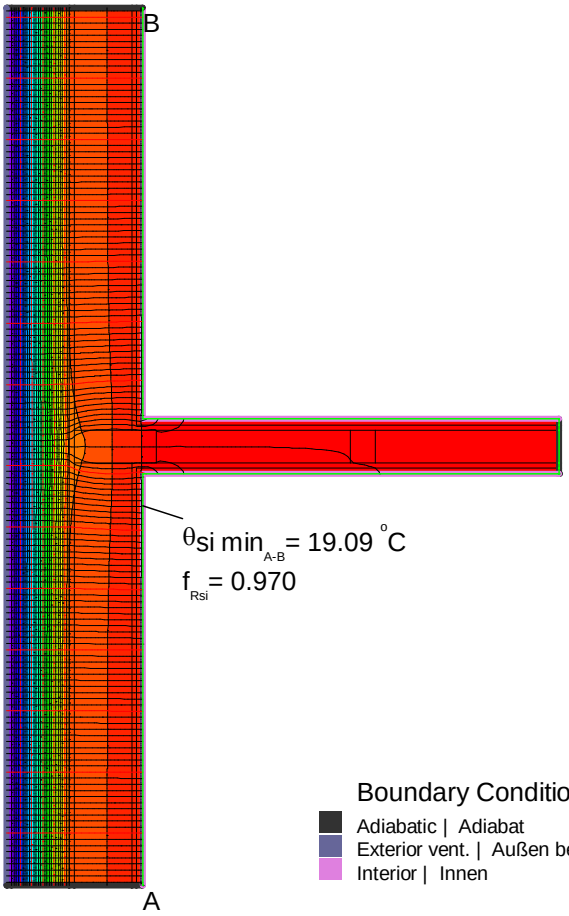


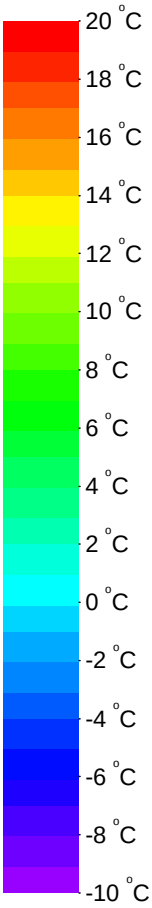
$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.410}{30.000 \cdot 1.400} = 0.224\ W/(m^2 \cdot K)$$

Material	λ[W/(m·K)]	ε
EQ-Wall_Air layer + timber	0.666	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Luftschicht, ruhend, horizontal, Dicke: 140 mm (1)	0.778	0.900
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900

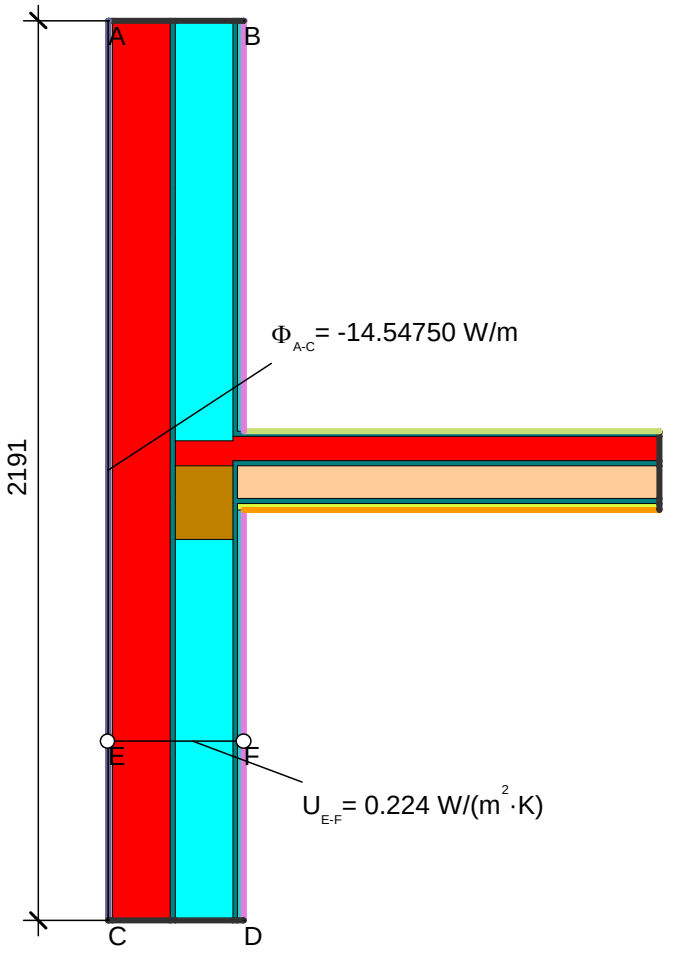
Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Interior | Innen		20.000	0.130	

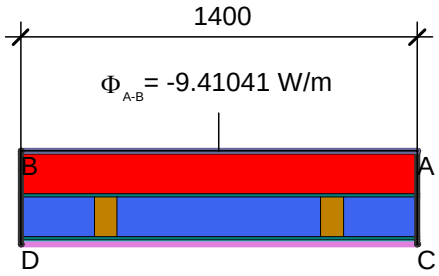
$$\psi_{C\text{-}E,\,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 = \frac{14.300}{30.000} - 0.224 \cdot 2.134 = -0.001\ W/(m \cdot K)$$





Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Interior | Innen		20.000	0.130	



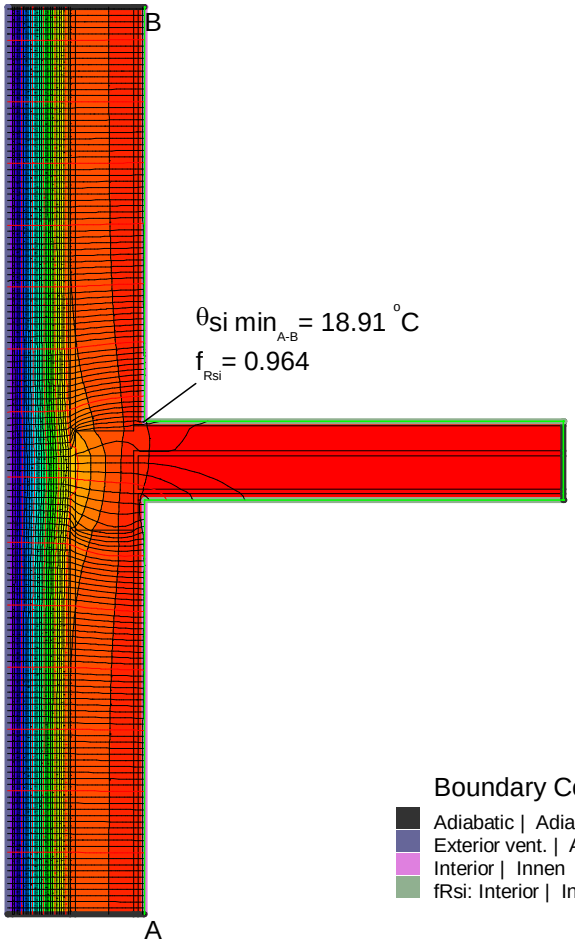


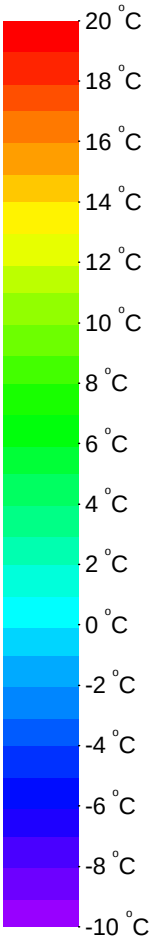
$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.410}{30.000 \cdot 1.400} = 0.224\ W/(m^2 \cdot K)$$

Material	λ[W/(m·K)]	ε
EQ-Wall_Air layer + timber	0.666	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board I Gipskartonplatten 900 kg/m3 10456	0.250	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Luftschicht, ruhend, aufwärts, Dicke: 80 mm	0.500	0.900
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900

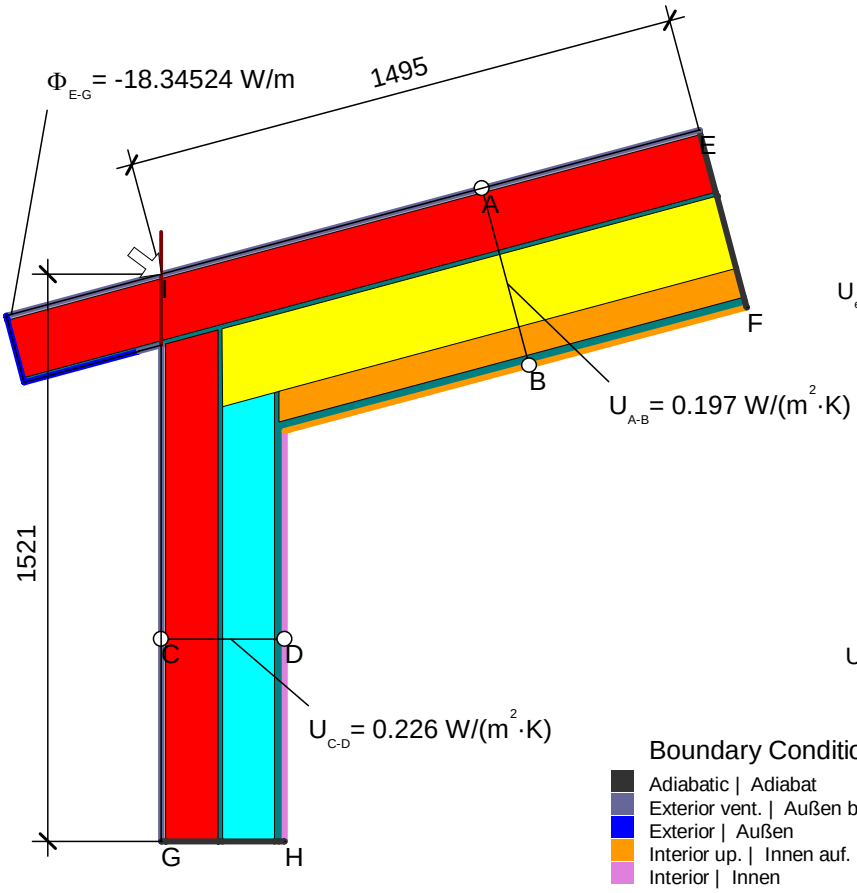
Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Int. flux down I Innen abwärts		20.000	0.170	
Interior up. | Innen auf.		20.000	0.100	
Interior | Innen		20.000	0.130	

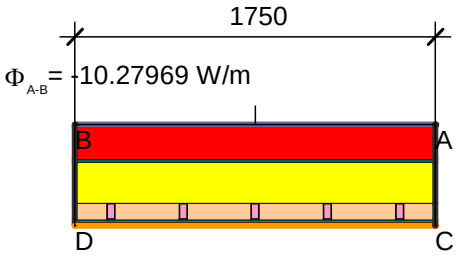
$$\psi_{A\text{-}C,\ *} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 = \frac{14.548}{30.000} - 0.224 \cdot 2.191 = -0.006\ W/(m \cdot K)$$



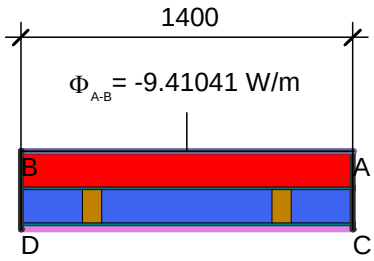


Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Interior | Innen		20.000	0.130	
fRsi: Interior | Innen		20.000	0.250	





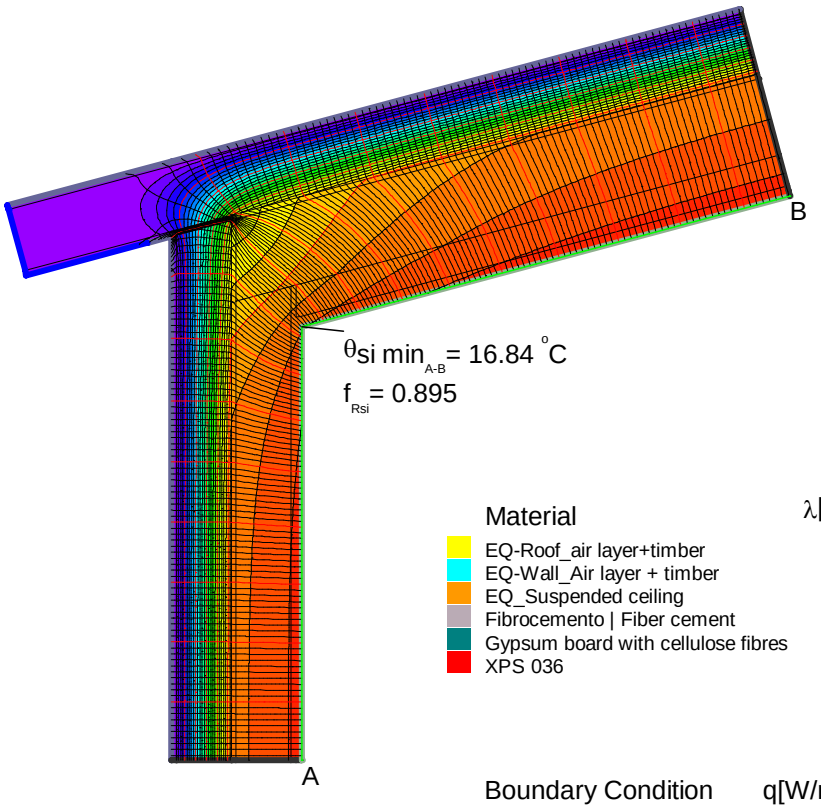
$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{10.280}{30.000 \cdot 1.750} = 0.196\ W/(m^2 \cdot K)$$

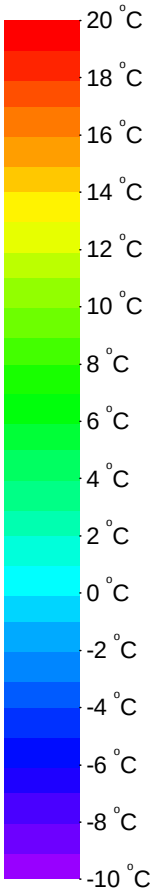


$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.410}{30.000 \cdot 1.400} = 0.224\ W/(m^2 \cdot K)$$

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Exterior | Außen		-10.000	0.040	
Interior up. | Innen auf.		20.000	0.100	
Interior | Innen		20.000	0.130	

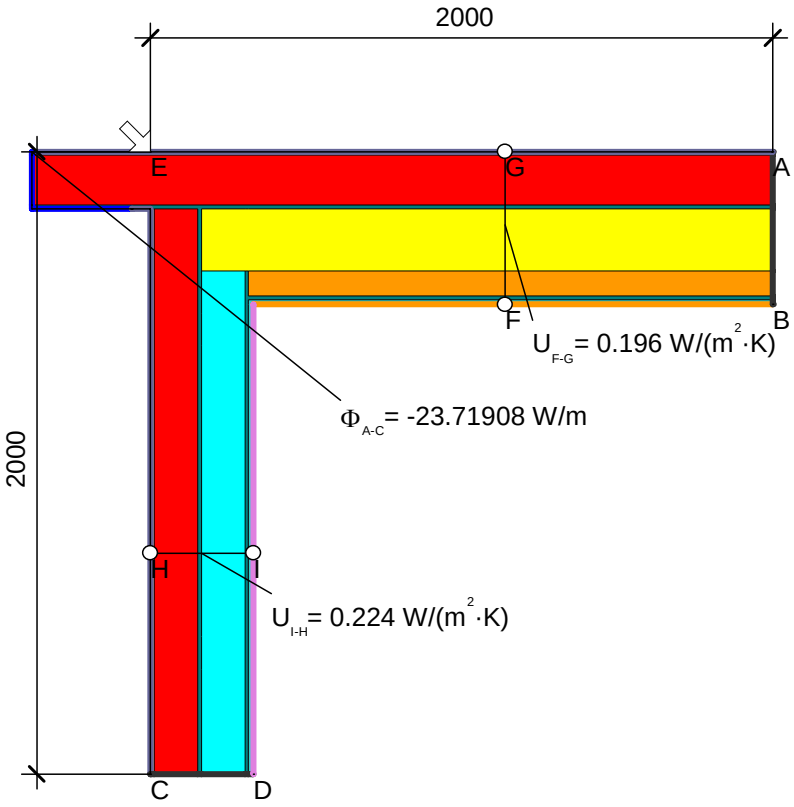
$$\psi_{E\text{-}I\text{-}G,\ *} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{18.345}{30.000} - 0.196 \cdot 1.495 - 0.224 \cdot 1.521 = -0.022\ W/(m \cdot K)$$

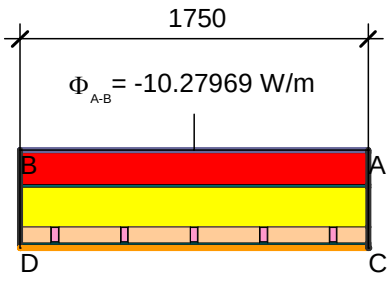




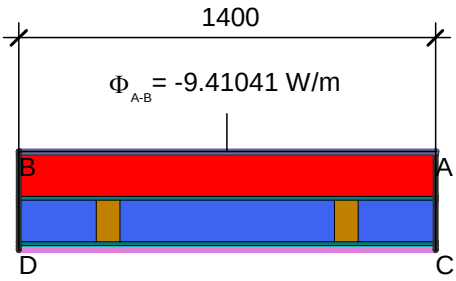
Material	λ[W/(m·K)]	ε
EQ-Roof_air layer+timber	0.920	0.900
EQ-Wall_Air layer + timber	0.666	0.900
EQ_Suspended ceiling	0.710	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board with cellulose fibres	0.669	0.900
XPS 036	0.036	0.900

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Exterior | Außen		-10.000	0.040	
fRsi: Interior | Innen		20.000	0.250	





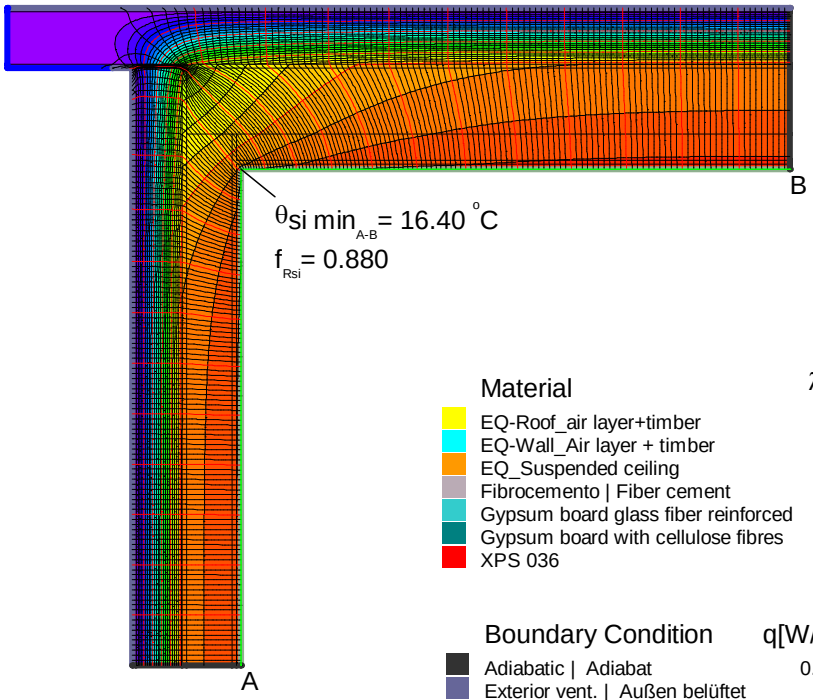
$$U_{eq\ A-B} = \frac{\Phi}{\Delta T \cdot b} = \frac{10.280}{30.000 \cdot 1.750} = 0.196\ W/(m^2 \cdot K)$$

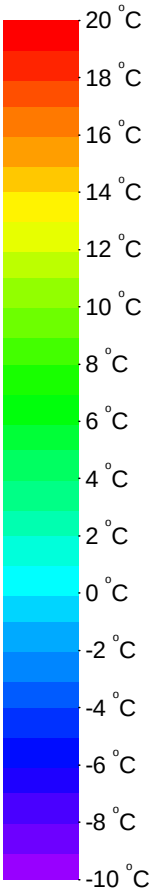


$$U_{eq\ A-B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.410}{30.000 \cdot 1.400} = 0.224\ W/(m^2 \cdot K)$$

$$\psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{23.719}{30.000} - 0.196 \cdot 2.000 - 0.224 \cdot 2.000 = -0.049\ W/(m \cdot K)$$

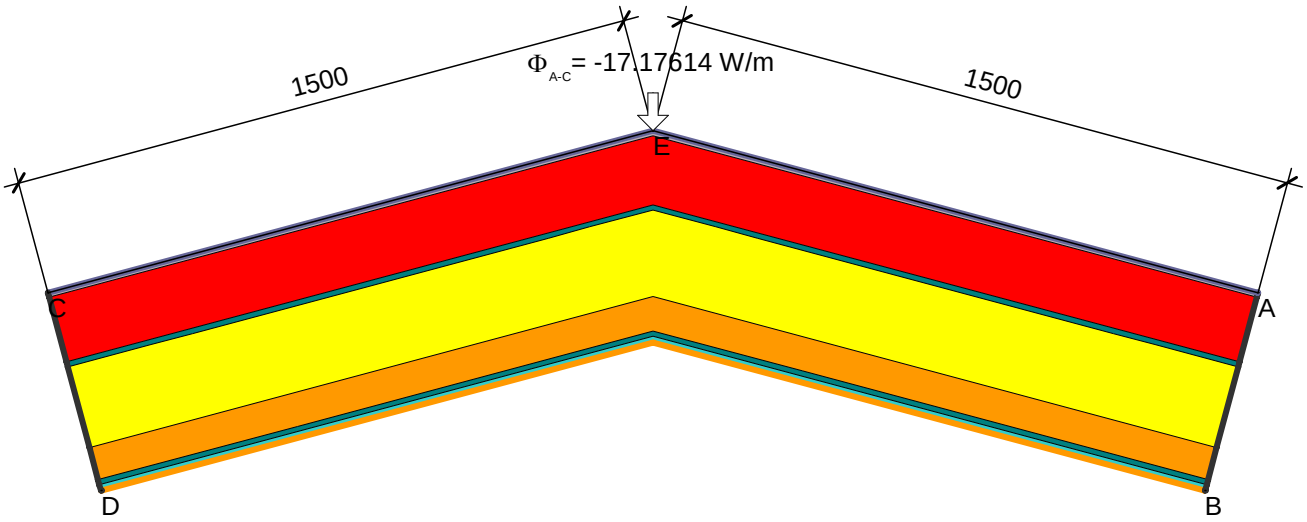
Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Exterior | Außen		-10.000	0.040	
Interior up. | Innen auf.		20.000	0.100	
Interior | Innen		20.000	0.130	



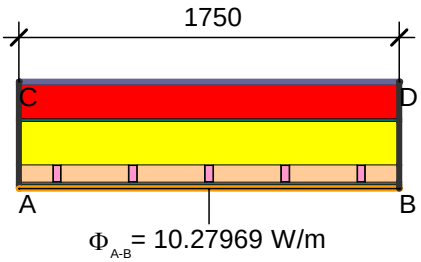


Material	λ[W/(m·K)]	ε
EQ-Roof_air layer+timber	0.920	0.900
EQ-Wall_Air layer + timber	0.666	0.900
EQ_Suspended ceiling	0.710	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
XPS 036	0.036	0.900

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Exterior | Außen		-10.000	0.040	
fRsi: Interior | Innen		20.000	0.250	



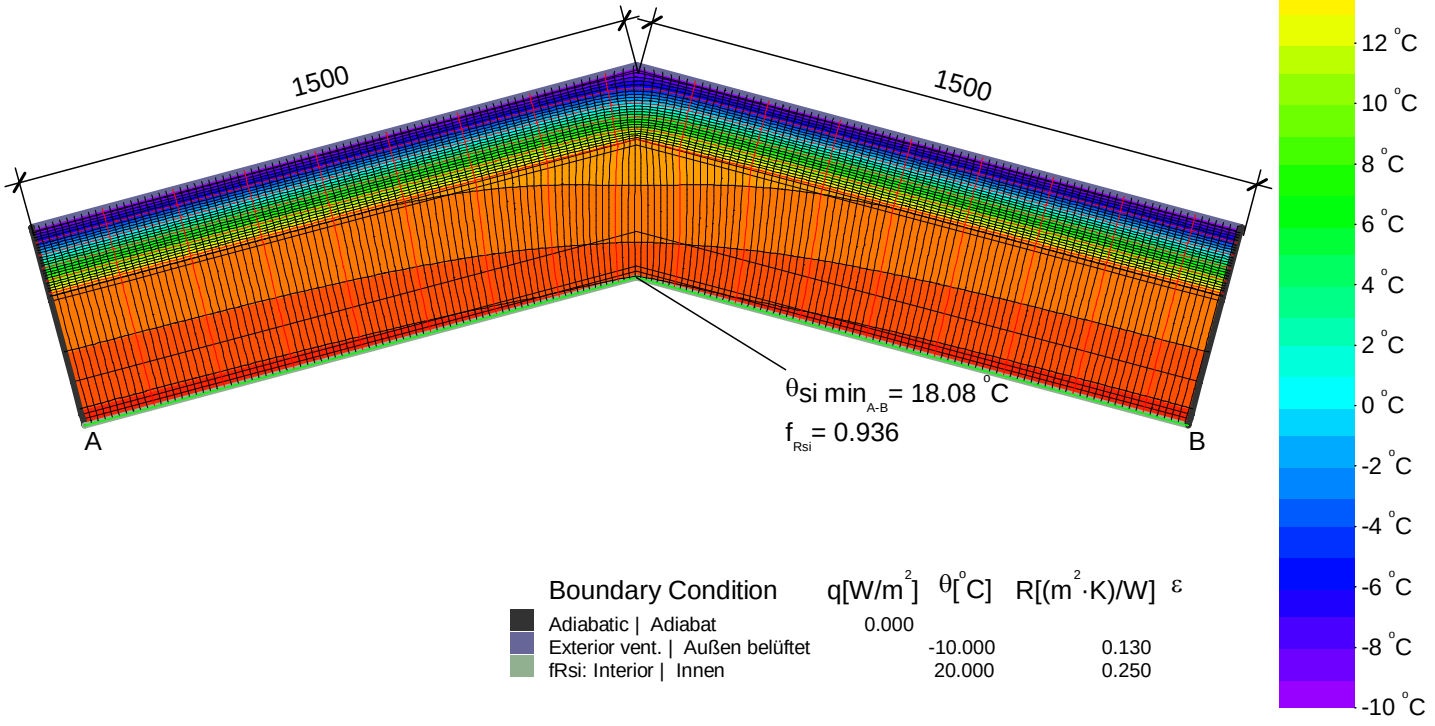
$$\psi_{A\text{-}E\text{-}C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{17.176}{30.000} - 0.196 \cdot 1.500 - 0.196 \cdot 1.500 = -0.015 \text{ W/(m·K)}$$



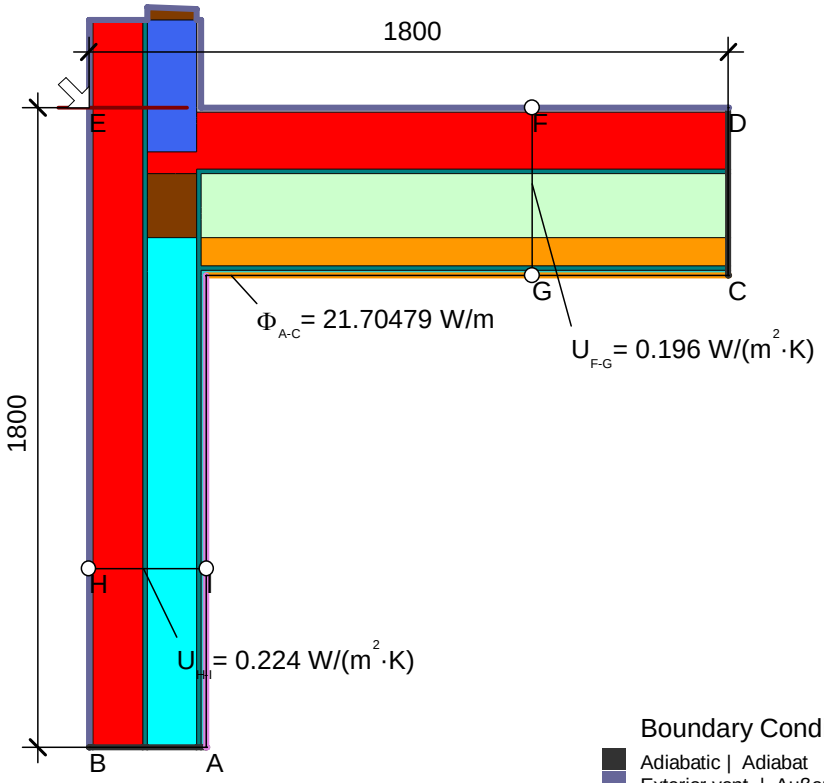
Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Interior up. | Innen auf.		20.000	0.100	

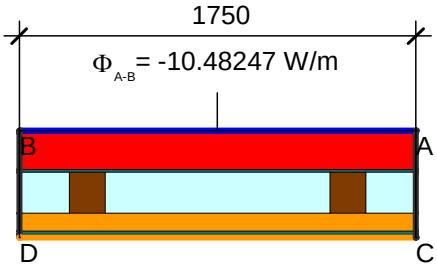
Material	λ[W/(m·K)]	ε
EQ-Roof_air layer+timber	0.920	0.900
EQ_Suspended ceiling	0.710	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
XPS 036	0.036	0.900

$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{10.280}{30.000 \cdot 1.750} = 0.196 \text{ W/(m²·K)}$$

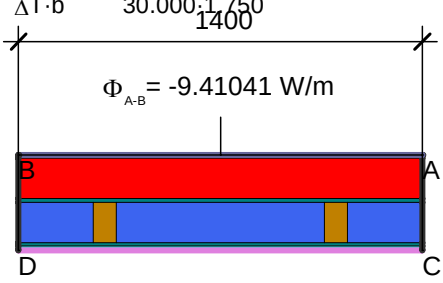


Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
fRsi: Interior | Innen		20.000	0.250	





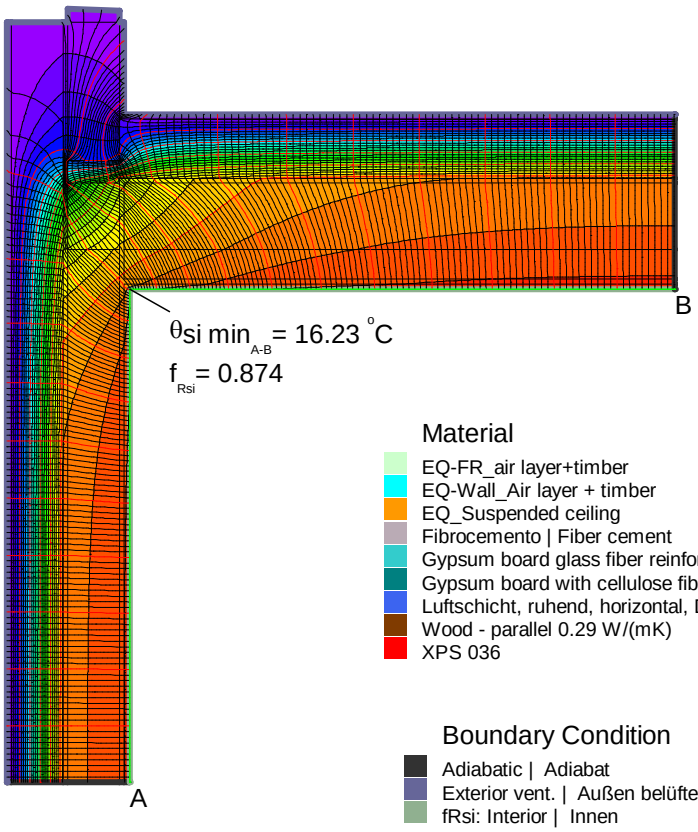
$$U_{eq\ A-B} = \frac{\Phi}{\Delta T \cdot b} = \frac{10.482}{30.000 \cdot 1.750} = 0.200\ W/(m^2 \cdot K)$$



$$U_{eq\ A-B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.410}{30.000 \cdot 1.400} = 0.224\ W/(m^2 \cdot K)$$

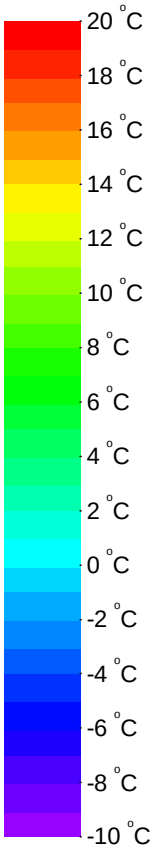
Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Interior up. | Innen auf.		20.000	0.100	
Interior | Innen		20.000	0.130	

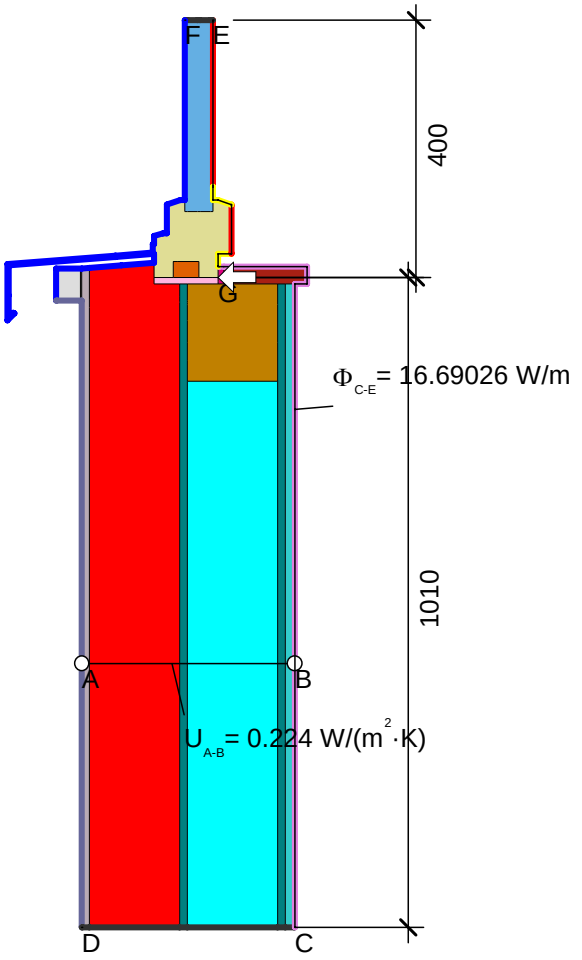
$$\psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{21.705}{30.000} - 0.224 \cdot 1.800 - 0.200 \cdot 1.800 = -0.039\ W/(m \cdot K)$$

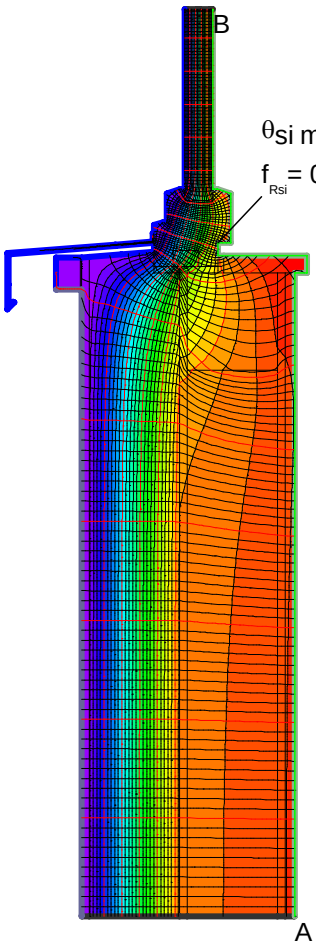


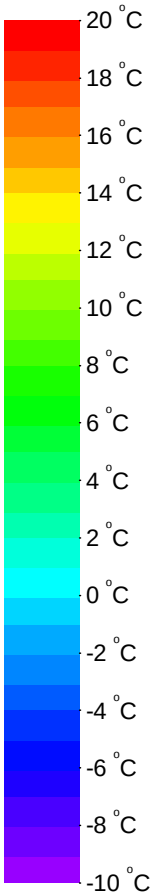
Material	λ[W/(m·K)]	ε
EQ-FR_air layer+timber	0.900	0.900
EQ-Wall_Air layer + timber	0.666	0.900
EQ_Suspended ceiling	0.710	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Luftschicht, ruhend, horizontal, Dicke: 140 mm (1)	0.778	0.900
Wood - parallel 0.29 W/(mK)	0.290	0.900
XPS 036	0.036	0.900

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
fRsi: Interior | Innen		20.000	0.250	





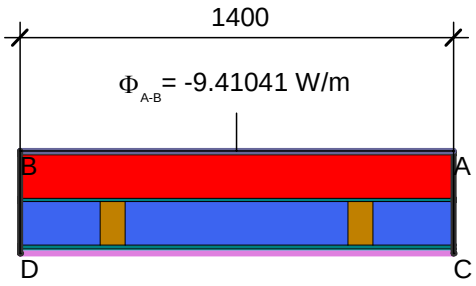




$$\psi_{C\text{-}G\text{-}E,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - \frac{\Phi_2}{\Delta T} = \frac{16.690}{30.000} - 0.224 \cdot 1.010 - \frac{9.453}{30.000} = 0.015\ \text{W/(m·K)}$$

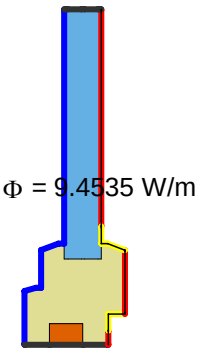
Material	λ[W/(m·K)]	ε
Aluminum I Aluminium 10456	160.000	0.900
EQ-Wall_Air layer + timber	0.666	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Hardwood I Hartholz 0.18 700 kg/m3 10456	0.180	0.900
Insulation I Wärmedämmung 050	0.050	0.900
PU in-situ foam I PU-Ortschaum 040	0.040	0.900
Panel I Maske	0.035	0.900
Silicone I Silikon	0.350	0.900
Softwood, OSB I Weichholz, OSB ISO 10456	0.130	0.900
Unvent. cavity I unbel. Hohlr. *		
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900

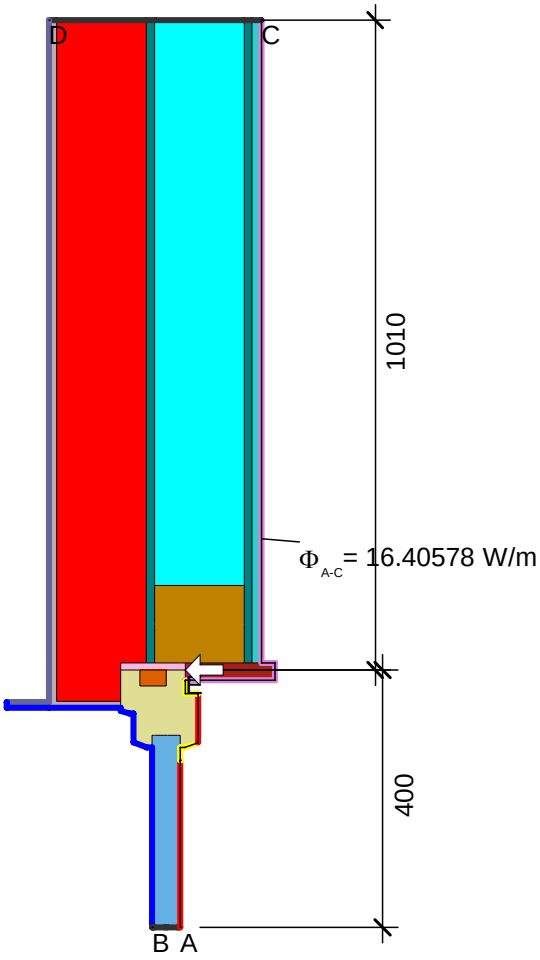
* EN ISO 10077-2:2017, 6.4.3

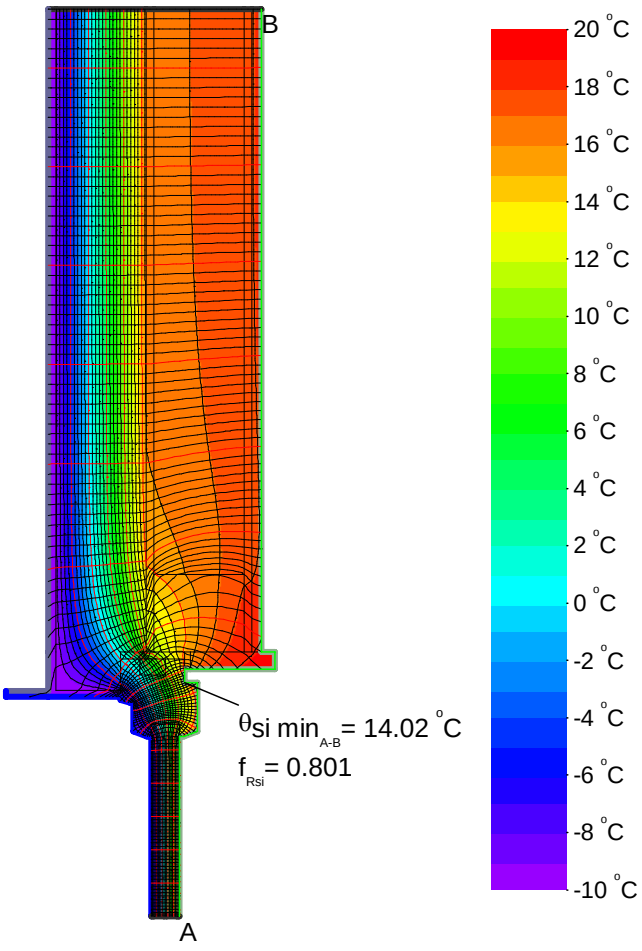


$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.410}{30.000 \cdot 1.400} = 0.224\ \text{W/(m²·K)}$$

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Exterior | Außen		-10.000	0.040	
Interior | Innen		20.000	0.130	
Interior, frame, normal		20.000	0.130	
Interior, frame, reduced		20.000	0.200	
e 0,9 Cavity I Hohlraum				0.900

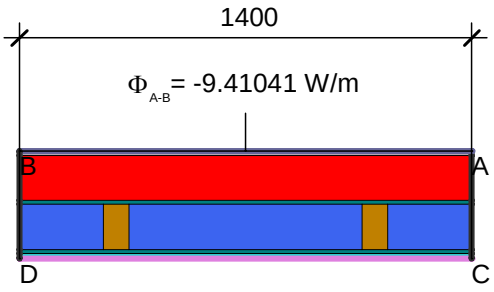






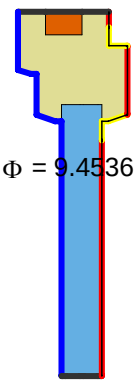
$$\psi_{A\text{-}E\text{-}C,\,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_I}{\Delta T} - U_2 \cdot b_2 = \frac{16.406}{30.000} - \frac{9.454}{30.000} - 0.224 \cdot 1.010 = 0.005\ W/(m \cdot K)$$

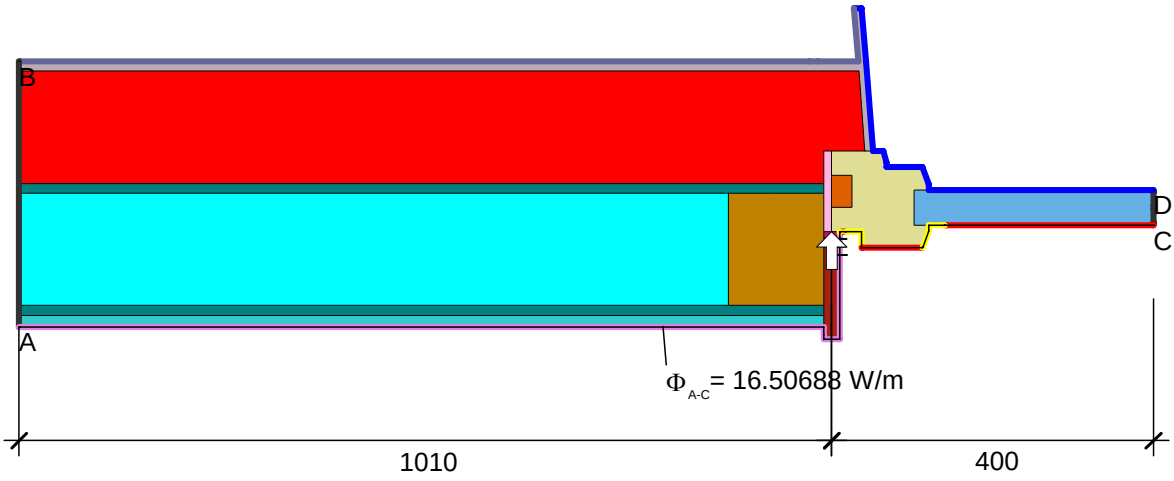
Material	λ[W/(m·K)]	ε
EQ-Wall_Air layer + timber	0.666	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Hardwood I Hartholz 0.18 700 kg/m3 10456	0.180	0.900
Insulation I Wärmedämmung 050	0.050	0.900
PU in-situ foam I PU-Ortschaum 040	0.040	0.900
Panel I Maske	0.035	0.900
Silicone I Silikon	0.350	0.900
Softwood, OSB I Weichholz, OSB ISO 10456	0.130	0.900
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900

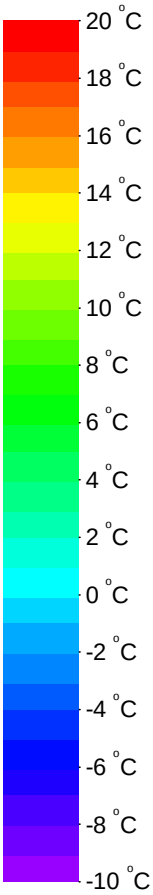


$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.410}{30.000 \cdot 1.400} = 0.224\ W/(m^2 \cdot K)$$

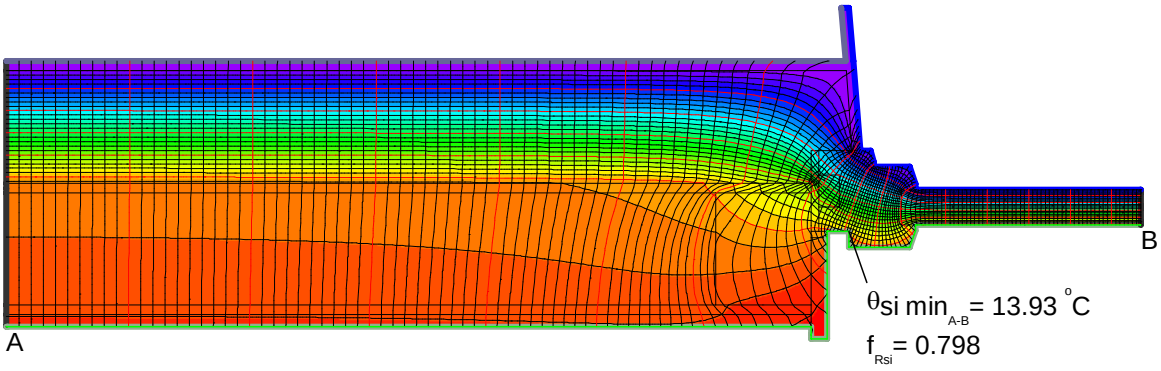
Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Aussen Standard		-10.000	0.040	
Exterior vent. | Außen belüftet		-10.000	0.130	
Interior I Innen		20.000	0.130	
Interior, frame, normal		20.000	0.130	
Interior, frame, reduced		20.000	0.200	

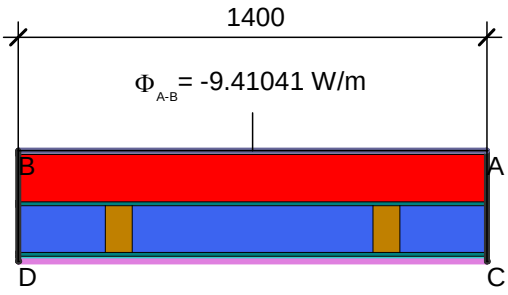






$$\psi_{A\text{-}E\text{-}C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - \frac{\Phi_2}{\Delta T} = \frac{16.507}{30.000} - 0.224 \cdot 1.010 - \frac{9.454}{30.000} = 0.009\ \text{W/(m·K)}$$

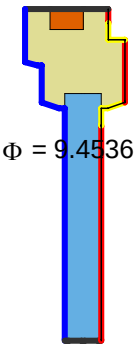


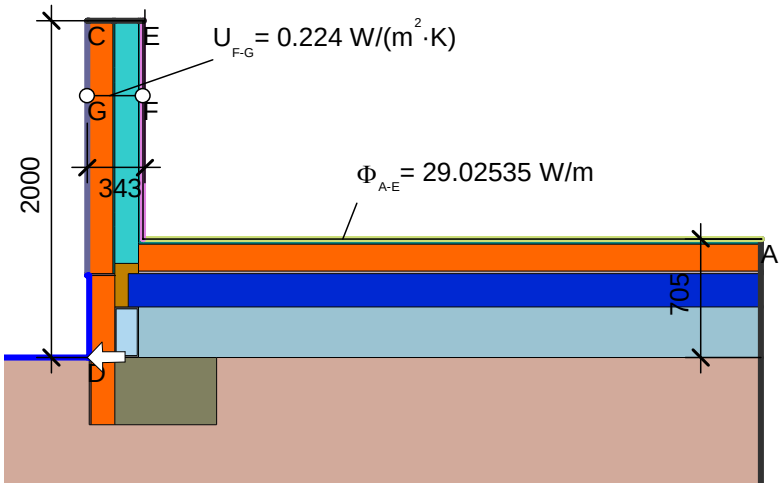


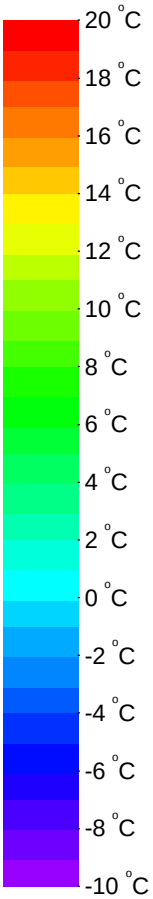
$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.410}{30.000 \cdot 1.400} = 0.224\ \text{W/(m}^2\text{·K)}$$

Material	λ[W/(m·K)]	ε
EQ-Wall_Air layer + timber	0.666	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Hardwood I Hartholz 0.18 700 kg/m3 10456	0.180	0.900
Insulation I Wärmedämmung 050	0.050	0.900
PU in-situ foam I PU-Ortschaum 040	0.040	0.900
Panel I Maske	0.035	0.900
Silicone I Silikon	0.350	0.900
Softwood, OSB I Weichholz, OSB ISO 10456	0.130	0.900
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900

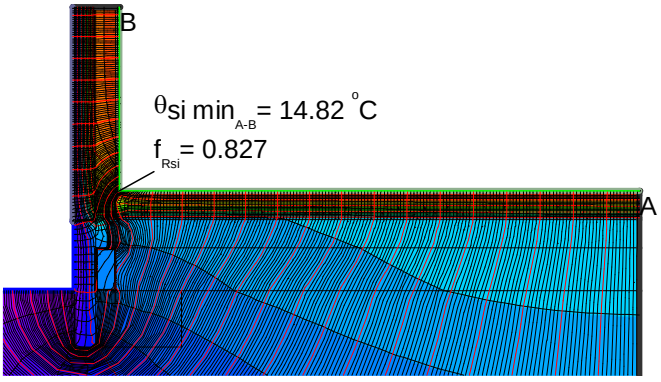
Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Exterior | Außen		-10.000	0.040	
Innen Fensterrahmen Reduziert		20.000	0.200	
Innen Fensterrahmen Standard		20.000	0.130	
Interior | Innen		20.000	0.130	

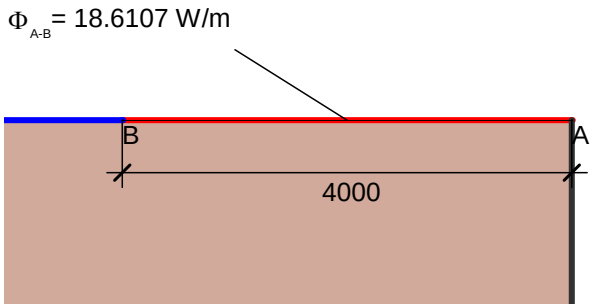




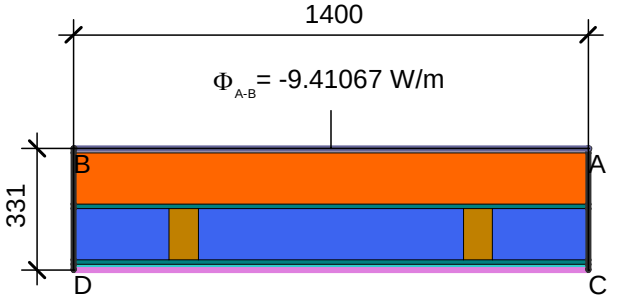


$$\psi_{A\text{-}D\text{-}E,\,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_i}{\Delta T} - U_2 \cdot b_2 = \frac{29.025}{30.000} - \frac{18.611}{30.000} - 0.224 \cdot 2.000 = -0.101 \text{ W/(m·K)}$$





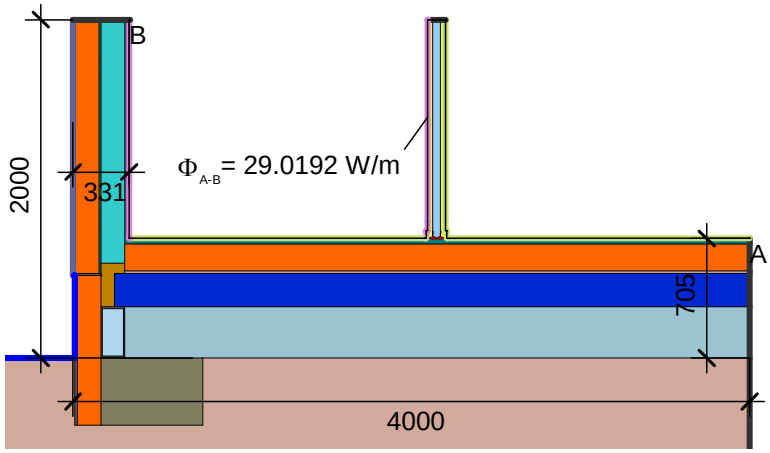
Material	λ[W/(m·K)]	ε
Aluminum I Aluminium 10456	160.000	0.900
Concrete, 1% Steel I Beton, 1% Stahl ISO 10456	2.300	0.900
EPDM	0.250	0.900
EQ-Wall_Air layer + timber	0.656	0.900
Fibrocemento | Fiber cement	1.200	0.900
Ground I Erdreich	2.000	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Luftschicht, ruhend, horizontal, Dicke: 280 mm	1.556	0.900
Luftschicht, schwach belüftet, aufwärts, Dicke: 200 mm	2.500	0.900
Luftschicht, schwach belüftet, aufwärts, Dicke: 300 mm	3.750	0.900
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900



$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.411}{30.000 \cdot 1.400} = 0.224 \text{ W/(m²·K)}$$

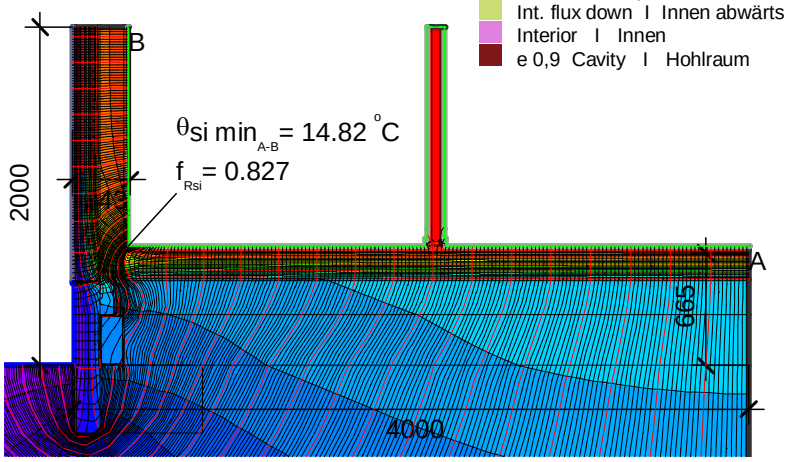
Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic	0.000			
Adiabatic | Adiabat	0.000			
Exterior I Außen		-10.000	0.040	
Exterior vent. | Außen belüftet		-10.000	0.130	
Int. flux down I Innen abwärts		20.000	0.170	
Interior I Innen		20.000	0.130	

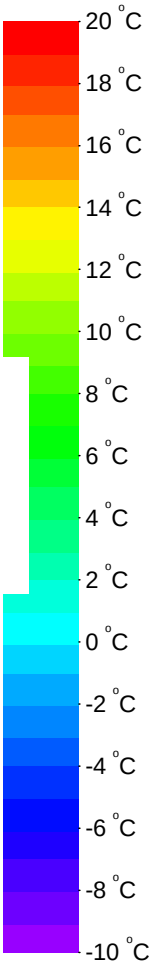
Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic	0.000			
Adiabatic | Adiabat	0.000			
Exterior I Außen		-10.000	0.040	
Exterior vent. | Außen belüftet		-10.000	0.130	
fRsi: Interior I Innen		20.000	0.250	

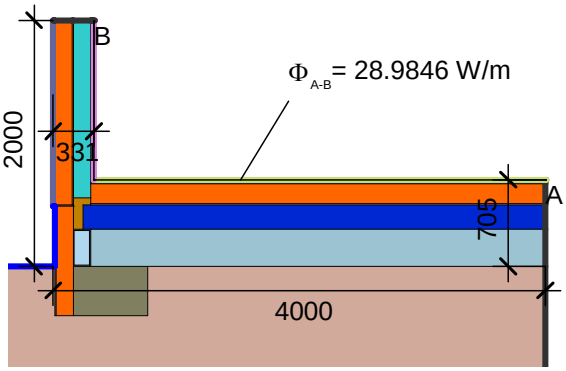


$\Psi_{FSIW} = (Q_{FSIW} - Q_{FSEW}) / \Delta T = (29.0192 - 28.9846) / 30 = 0{,}001$ W/mK

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic I Adiabatisch	0.000			
Adiabatic | Adiabat	0.000			
Exterior I Außen		-10.000	0.040	
Exterior vent. | Außen belüftet		-10.000	0.130	
Int. flux down I Innen abwärts		20.000	0.170	
Interior I Innen		20.000	0.130	
e 0,9 Cavity I Hohlraum				0.900







Material	λ[W/(m·K)]	ε
Aluminum I Aluminium 10456	160.000	0.900
Concrete, 1% Steel I Beton, 1% Stahl ISO 10456	2.300	0.900
EPDM	0.250	0.900
EQ-Wall_Air layer + timber	0.656	0.900
Eq_1 Service Cavity	0.046	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gips 1500 kg/m3	0.560	0.900
Ground I Erdreich	2.000	0.900
Gypsum board I Gipskartonplatten 900 kg/m3 10456	0.250	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Knauf Ultracoustic Suelo TP 037 +10%	0.041	0.900
Luftschicht, ruhend, horizontal, Dicke: 280 mm	1.556	0.900
Luftschicht, schwach belüftet, aufwärts, Dicke: 200 mm	2.500	0.900
Luftschicht, schwach belüftet, aufwärts, Dicke: 300 mm	3.750	0.900
Polyethylenschaum	0.050	0.900
Steel I Stahl	50.000	0.900
Unvent. cavity I unbel. Hohlr. *		
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900

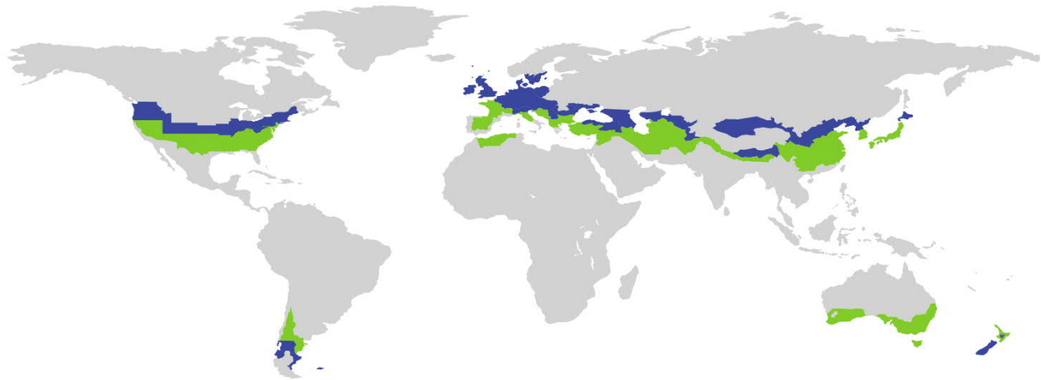
* EN ISO 10077-2:2017, 6.4.3

CERTIFICATE

Certified Passive House Component

ID: 1598cs04 valid until 31. December 2021

Passive House Institute
Dr. Wolfgang Feist
64342 Darmstadt
GERMANY



Category	**Construction system | Lightweight timber construction**
Manufacturer	**Thermochip SLU** **Carballeda de Valdeorras (Ourense)** **España**
Product name	**Thermochip HOUSING SATE-WALL**

This certificate for the warm, temperate climate zone was awarded based on the following criteria

Hygiene criterion

The minimum temperature factor of the interior surfaces is	$f_{Rsi=0,25m^2K/W} \geq$	**0.65**

Comfort criterion

The U-value of the installed windows is	$U_{W,i} \leq$	**1.05** W/(m²K)

Efficiency criteria

Heat transfer coefficient of building envelope	$U*f_{PHI} \leq$	**0.30** W/(m²K)
Temperature factor of opaque junctions	$f_{Rsi=0,25m^2K/W} \geq$	**0.82**
Thermal bridge-free design for key connection details	$\Psi \leq$	**0.01** W/(mK)

An airtightness concept for all components and connection details was provided

warm, temperate climate

CERTIFIED COMPONENT

Passive House Institute

Thermochip SLU
A Medua s/n 32330 Carballeda de Valdeorras (Ourense) España
Phone: | +34 988 33 55 85 | lfernandez@thermochip.com | www.thermochip.com

Opaque building envelope

With the Thermochip HOUSING Construction System the wintertime thermal insulation of buildings can be ensured. The system is constructed out of timber studs, beams and two sandwich panels. The external sandwich panel (12/80/12 mm) comprises a board of fibre cement to the outside, a core of XPS (</=0,036 W/mK) and internal composite board with cellulose fibres. The internal sandwich panel (12/60/12 mm) uses the same core of XPS but two composite boards with cellulose fibres. The assembly is thereby insulated both to the outside and inside.
For the purpose of certification, a three-dimensional simulation was carried out to deter-mine the effect of the timber roof beams which penetrates the external wall at eaves level.
The certification does not take into account point thermal bridges caused by structural columns or e.g. balcony connections, which must to be as-sessed separately. As investigated, the system is deemed suitable for passive houses in the warm-temperate climate zone, as the regular U-values of the exterior components are below 0,25 W/m²K and the connections meet the criteria of 'thermal bridge free'. The surface temperature of all con-nections (with the

Explanatory notes

The Passive House Institute has defined interna-tional component criteria for seven climate zones based on hygiene, comfort and affordability crite-ria. In principle, components which have been certified for climate zones with higher require-ments may also be used in climates with less strin-gent requirements. Their use might make econom-ic sense in certain circumstances.

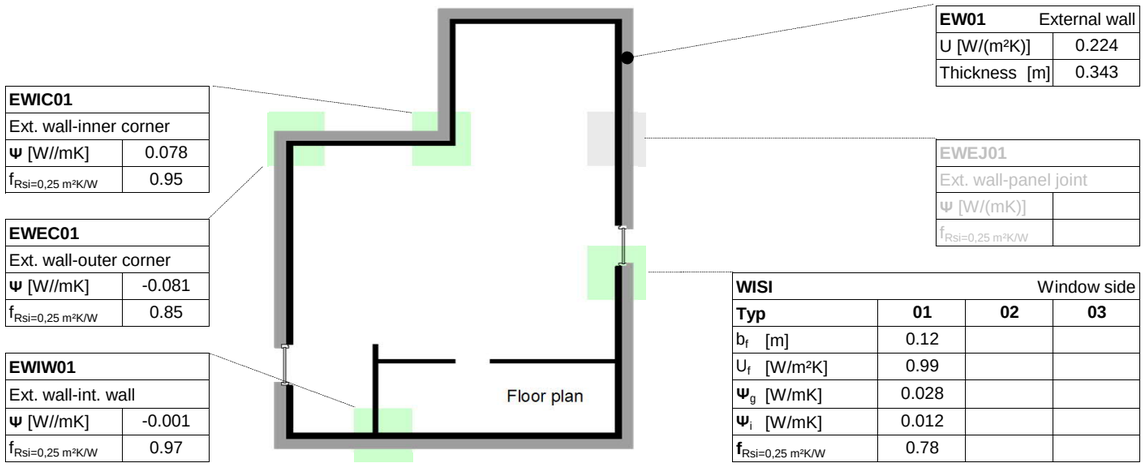
Windows

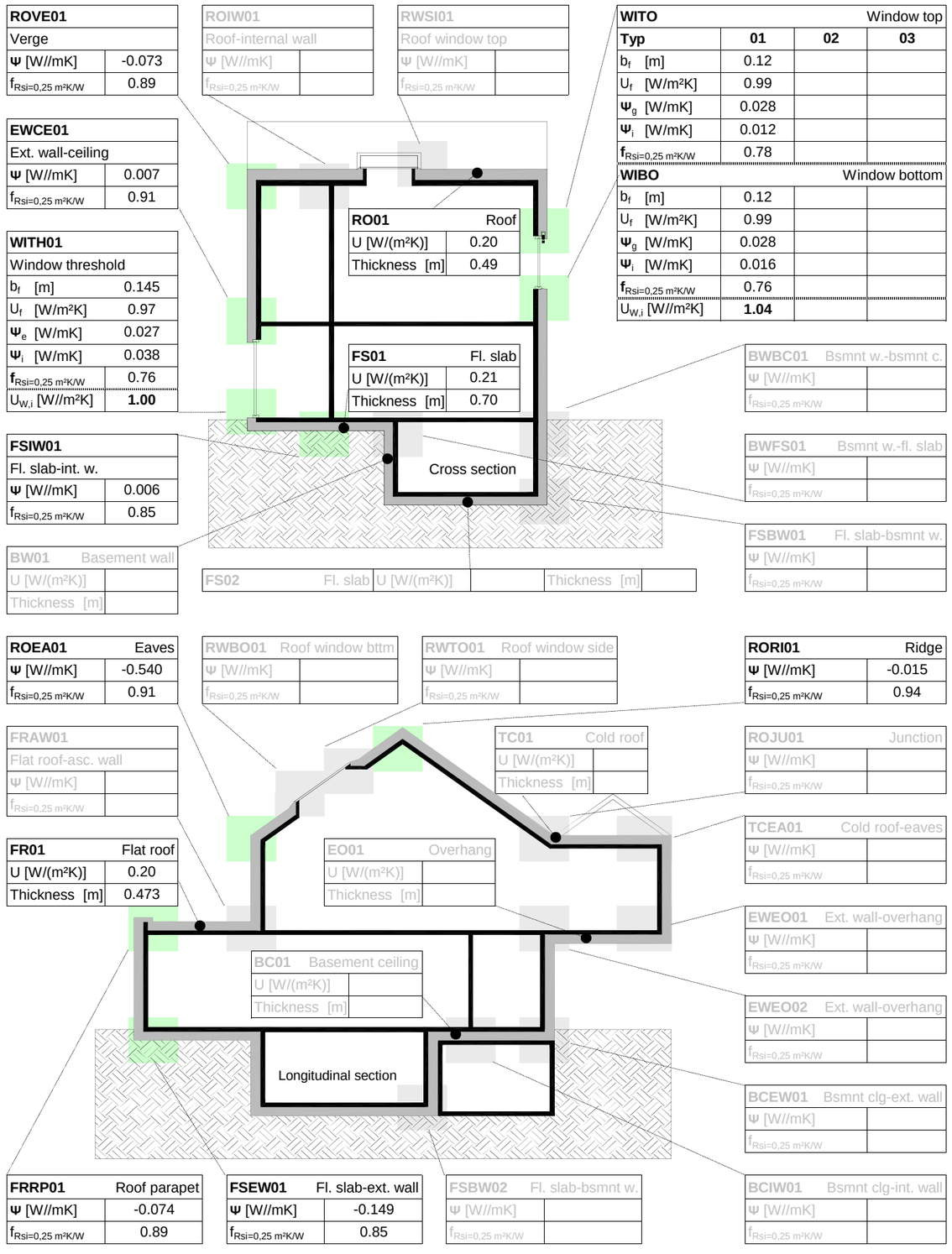
For the purposes of certification a standard passive house window (Uw = 1,00 W/m²K with Ug = 0,90 W/m²K) was used. The overall U-value of the installed window of standard size (1,23 m wide by 1,48 m tall) should be no more than 0,05 W/m²K greater than the Uw to ensure occupant comfort - this criteria is met in this instance.

Airtightness concept

Airtightness of the system is achieved in the following way: windows and doors are installed with permanently elastic sealing materials and suitable airtight connection membranes and profiles. The airtight layer of the wall is the interior gypsum fibre board of the outer panel. In the roof and floor slab where only one sandwich panel is used, the air tight layer remains on the interior gypsum fibre board of the panel. Joints between panels and connections with other building elements are sealed with Soudal Soudatight SP airtight paint.

Thermal bridge not calculated
Criteria achieved
Efficieny criteria not achieved
Hygiene or comfort criterion not achieved



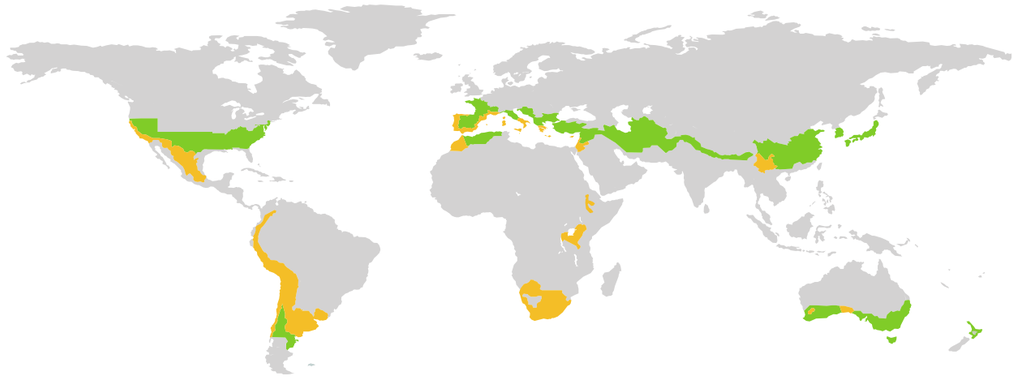


CERTIFICATE

Certified Passive House Component

ID: 1598cs04 valid until 31. December 2021

Passive House Institute
Dr. Wolfgang Feist
64342 Darmstadt
GERMANY



Category	**Construction system | Lightweight timber construction**
Manufacturer	**Thermochip SLU** **Carballeda de Valdeorras (Ourense)** **España**
Product name	**Thermochip HOUSING SATE-WALL**

This certificate for the warm, temperate climate zone was awarded based on the following criteria

Hygiene criterion

The minimum temperature factor of the interior surfaces is	$f_{Rsi=0,25m^2K/W} \geq$	**0.65**

Comfort criterion

The U-value of the installed windows is	$U_{W,i} \leq$	**1.05** W/(m²K)

Efficiency criteria

Heat transfer coefficient of building envelope	$U*f_{PHI} \leq$	**0.30** W/(m²K)
Temperature factor of opaque junctions	$f_{Rsi=0,25m^2K/W} \geq$	**0.82**
Thermal bridge-free design for key connection details	$\Psi \leq$	**0.01** W/(mK)

An airtightness concept for all components and connection details was provided

warm, temperate climate

CERTIFIED COMPONENT
Passive House Institute

Thermochip SLU
A Medua s/n 32330 Carballeda de Valdeorras (Ourense) España
Phone: | +34 988 33 55 85 | lfernandez@thermochip.com | www.thermochip.com

Opaque building envelope

With the Thermochip HOUSING Construction System the wintertime thermal insulation of buildings can be ensured. The system is constructed out of timber studs, beams and two sandwich panels. The external sandwich panel (12/80/12 mm) comprises a board of fibre cement to the outside, a core of XPS (</=0,036 W/mK) and internal composite board with cellulose fibres. The internal sandwich panel (12/60/12 mm) uses the same core of XPS but two composite boards with cellulose fibres. The assembly is thereby insulated both to the outside and inside.

For the purpose of certification, a three-dimensional simulation was carried out to determine the effect of the timber roof beams which penetrates the external wall at eaves level.

The certification does not take into account point thermal bridges caused by structural columns or e.g. balcony connections, which must to be assessed separately. As investigated, the system is deemed suitable for passive houses in the warm-temperate climate zone, as the regular U-values of the exterior components are below 0,25 W/m²K and the connections meet the criteria of 'thermal bridge free'.

Windows

For the purposes of certification a standard passive house window (Uw = 1,00 W/m²K with Ug = 0,90 W/m²K) was used. The overall U-value of the installed window of standard size (1,23 m wide by 1,48 m tall) should be no more than 0,05 W/m²K greater than the Uw to ensure occupant comfort - this criteria is met in this instance.

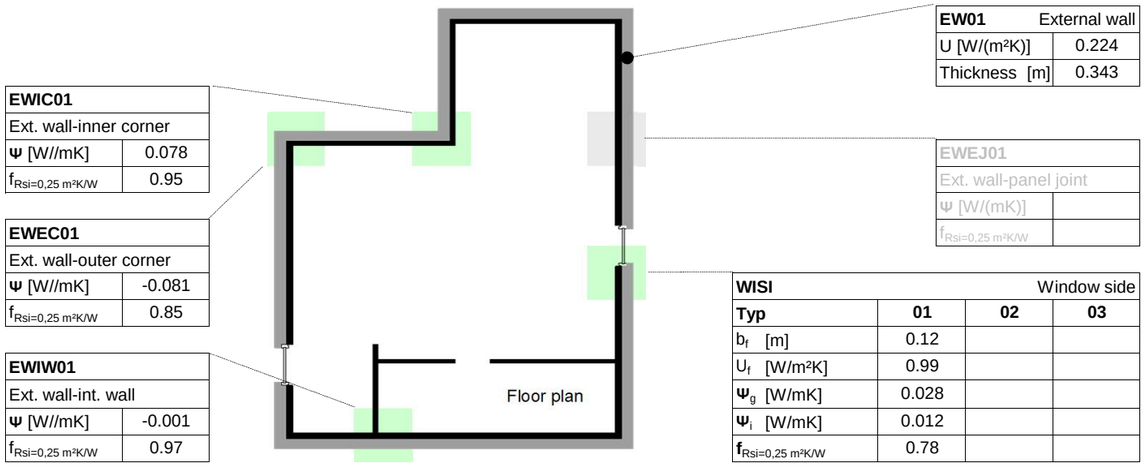
Airtightness concept

Airtightness of the system is achieved in the following way: windows and doors are installed with permanently elastic sealing materials and suitable airtight connection membranes and profiles. The airtight layer of the wall is the interior gypsum fibre board of the outer panel. In the roof and floor slab where only one sandwich panel is used, the air tight layer remains on the interior gypsum fibre board of the panel. Joints between panels and connections with other building elements are sealed with Soudal Soudatight SP airtight paint.

Explanatory notes

The Passive House Institute has defined international component criteria for seven climate zones based on hygiene, comfort and affordability criteria. In principle, components which have been certified for climate zones with higher requirements may also be used in climates with less stringent requirements. Their use might make economic sense in certain circumstances.

Thermal bridge not calculated
Criteria achieved
Efficieny criteria not achieved
Hygiene or comfort criterion not achieved



EWIC01	
Ext. wall-inner corner	
Ψ [W//mK]	0.078
$f_{Rsi=0,25\ m²K/W}$	0.95

EWEC01	
Ext. wall-outer corner	
Ψ [W//mK]	-0.081
$f_{Rsi=0,25\ m²K/W}$	0.85

EWIW01	
Ext. wall-int. wall	
Ψ [W//mK]	-0.001
$f_{Rsi=0,25\ m²K/W}$	0.97

EW01 External wall	
U [W/(m²K)]	0.224
Thickness [m]	0.343

EWEJ01	
Ext. wall-panel joint	
Ψ [W/(mK)]	
$f_{Rsi=0,25\ m²K/W}$	

WISI Window side			
Typ	**01**	**02**	**03**
b_f [m]	0.12		
U_f [W/m²K]	0.99		
Ψ_g [W/mK]	0.028		
Ψ_i [W/mK]	0.012		
$f_{Rsi=0,25\ m²K/W}$	0.78		

ROVE01	
Verge	
Ψ [W//mK]	-0.540
$f_{Rsi=0,25\ m²K/W}$	0.91

ROIW01	
Roof-internal wall	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

RWSI01	
Roof window top	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

WITO Window top			
Typ	**01**	**02**	**03**
b_f [m]	0.12		
U_f [W/m²K]	0.99		
Ψ_g [W/mK]	0.028		
Ψ_i [W/mK]	0.012		
$f_{Rsi=0,25\ m²K/W}$	0.78		

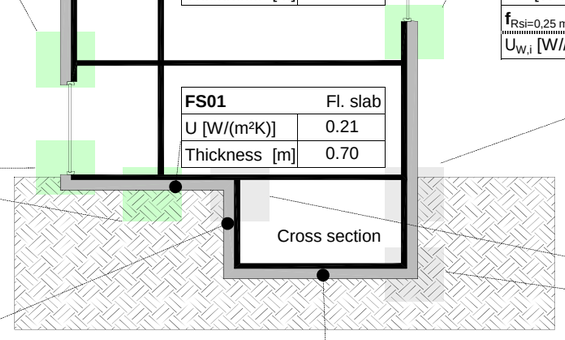
EWCE01	
Ext. wall-ceiling	
Ψ [W//mK]	0.007
$f_{Rsi=0,25\ m²K/W}$	0.91

RO01 Roof	
U [W/(m²K)]	0.20
Thickness [m]	0.49

WIBO Window bottom			
b_f [m]	0.12		
U_f [W/m²K]	0.99		
Ψ_g [W/mK]	0.028		
Ψ_i [W/mK]	0.016		
$f_{Rsi=0,25\ m²K/W}$	0.76		
$U_{W,i}$ [W//m²K]	**1.04**		

WITH01	
Window threshold	
b_f [m]	0.145
U_f [W/m²K]	0.97
Ψ_e [W/mK]	0.027
Ψ_i [W/mK]	0.038
$f_{Rsi=0,25\ m²K/W}$	0.76
$U_{W,i}$ [W//m²K]	**1.00**

FS01 Fl. slab	
U [W/(m²K)]	0.21
Thickness [m]	0.70



BWBC01 Bsmnt w.-bsmnt c.	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

FSIW01	
Fl. slab-int. w.	
Ψ [W//mK]	0.006
$f_{Rsi=0,25\ m²K/W}$	0.85

BWFS01 Bsmnt w.-fl. slab	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

FSBW01 Fl. slab-bsmnt w.	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

BW01 Basement wall	
U [W/(m²K)]	
Thickness [m]	

FS02 Fl. slab	U [W/(m²K)]		Thickness [m]	

ROEA01 Eaves	
Ψ [W//mK]	-0.540
$f_{Rsi=0,25\ m²K/W}$	0.91

RWBO01 Roof window bttm	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

RWTO01 Roof window side	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

RORI01 Ridge	
Ψ [W//mK]	-0.015
$f_{Rsi=0,25\ m²K/W}$	0.94

FRAW01	
Flat roof-asc. wall	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

TC01 Cold roof	
U [W/(m²K)]	
Thickness [m]	

ROJU01 Junction	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

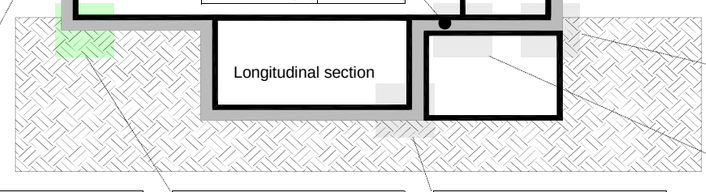
FR01 Flat roof	
U [W/(m²K)]	0.20
Thickness [m]	0.473

EO01 Overhang	
U [W/(m²K)]	
Thickness [m]	

TCEA01 Cold roof-eaves	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

EWEO01 Ext. wall-overhang	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

BC01 Basement ceiling	
U [W/(m²K)]	
Thickness [m]	



EWEO02 Ext. wall-overhang	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

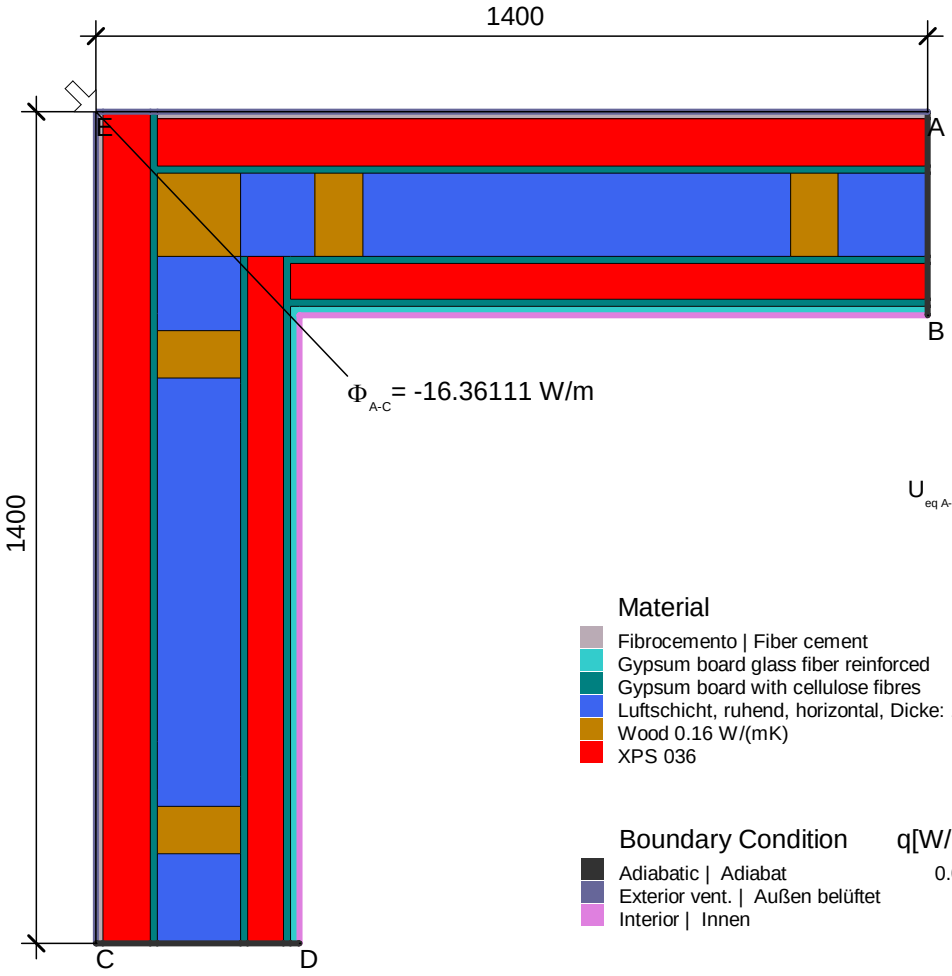
BCEW01 Bsmnt clg-ext. wall	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

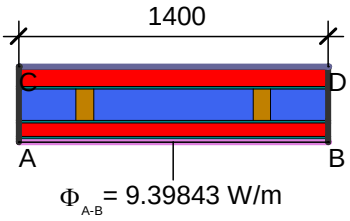
FRRP01 Roof parapet	
Ψ [W//mK]	-0.074
$f_{Rsi=0,25\ m²K/W}$	0.89

FSEW01 Fl. slab-ext. wall	
Ψ [W//mK]	-0.149
$f_{Rsi=0,25\ m²K/W}$	0.85

FSBW02 Fl. slab-bsmnt w.	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	

BCIW01 Bsmnt clg-int. wall	
Ψ [W//mK]	
$f_{Rsi=0,25\ m²K/W}$	



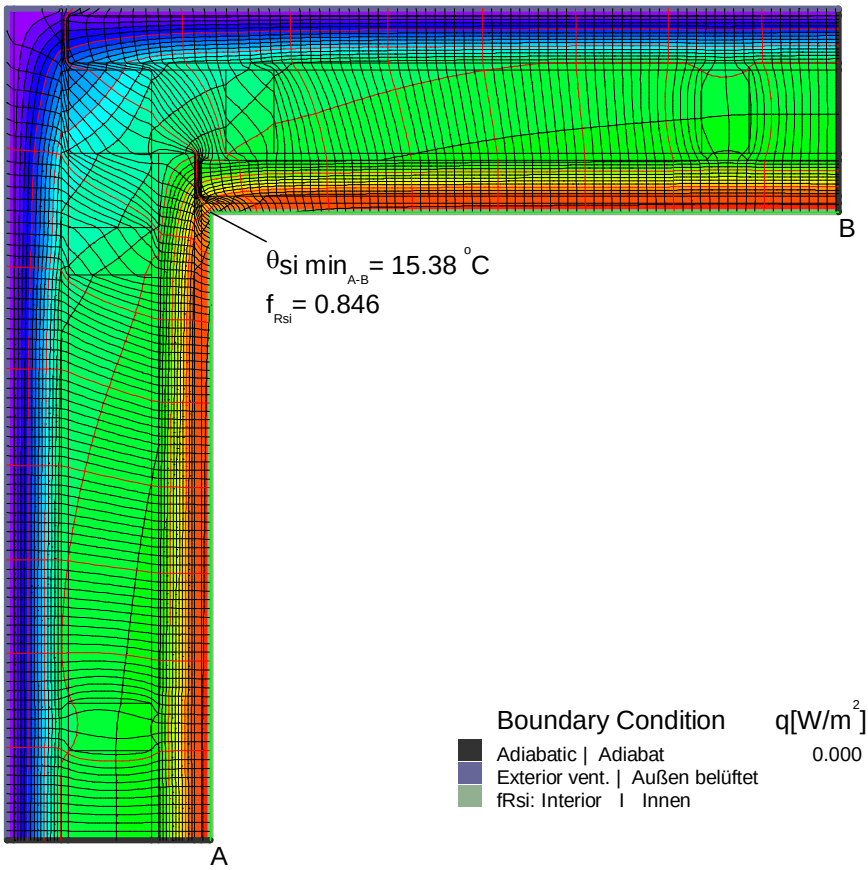


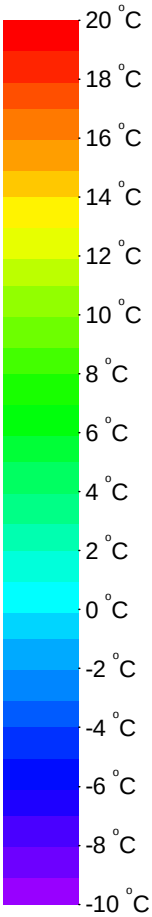
$$U_{eq\ A-B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.398}{30.000 \cdot 1.400} = 0.224\ W/(m^2 \cdot K)$$

Material	λ[W/(m·K)]	ε
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Luftschicht, ruhend, horizontal, Dicke: 140 mm (1)	0.778	0.900
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Interior | Innen		20.000	0.130	

$$\psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{16.361}{30.000} - 0.224 \cdot 1.400 - 0.224 \cdot 1.400 = -0.081\ W/(m \cdot K)$$

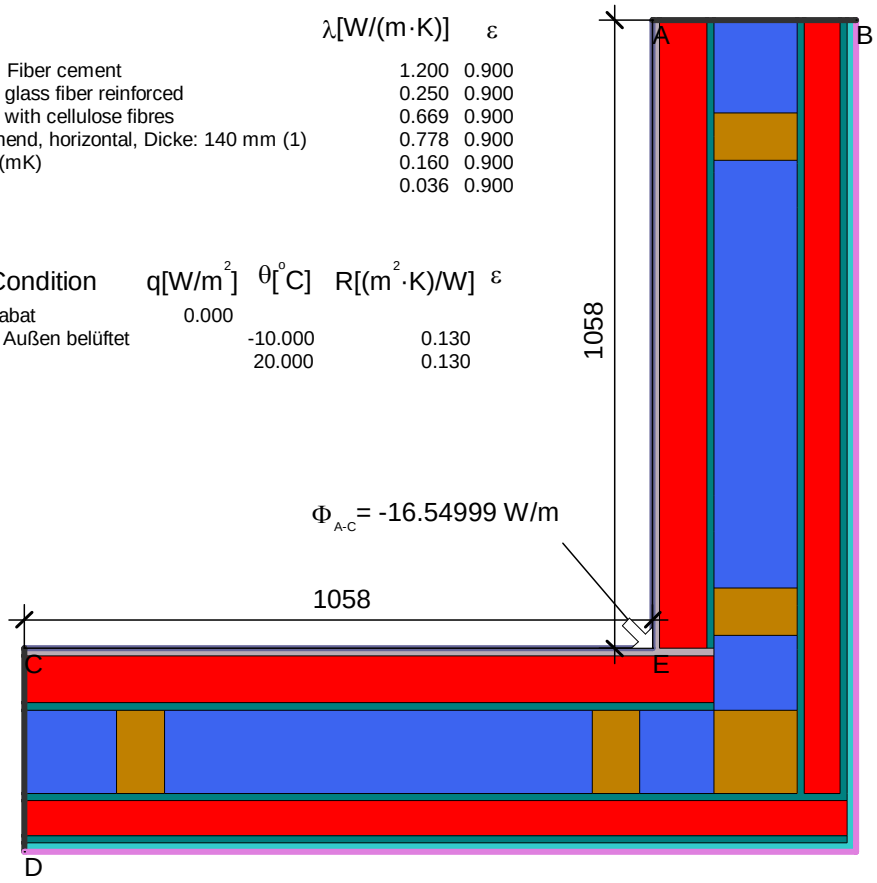




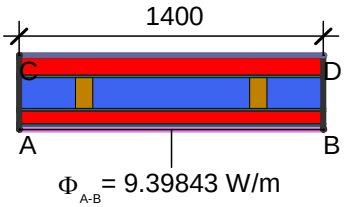
Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
fRsi: Interior I Innen		20.000	0.250	

Material	λ[W/(m·K)]	ε
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Luftschicht, ruhend, horizontal, Dicke: 140 mm (1)	0.778	0.900
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Interior | Innen		20.000	0.130	

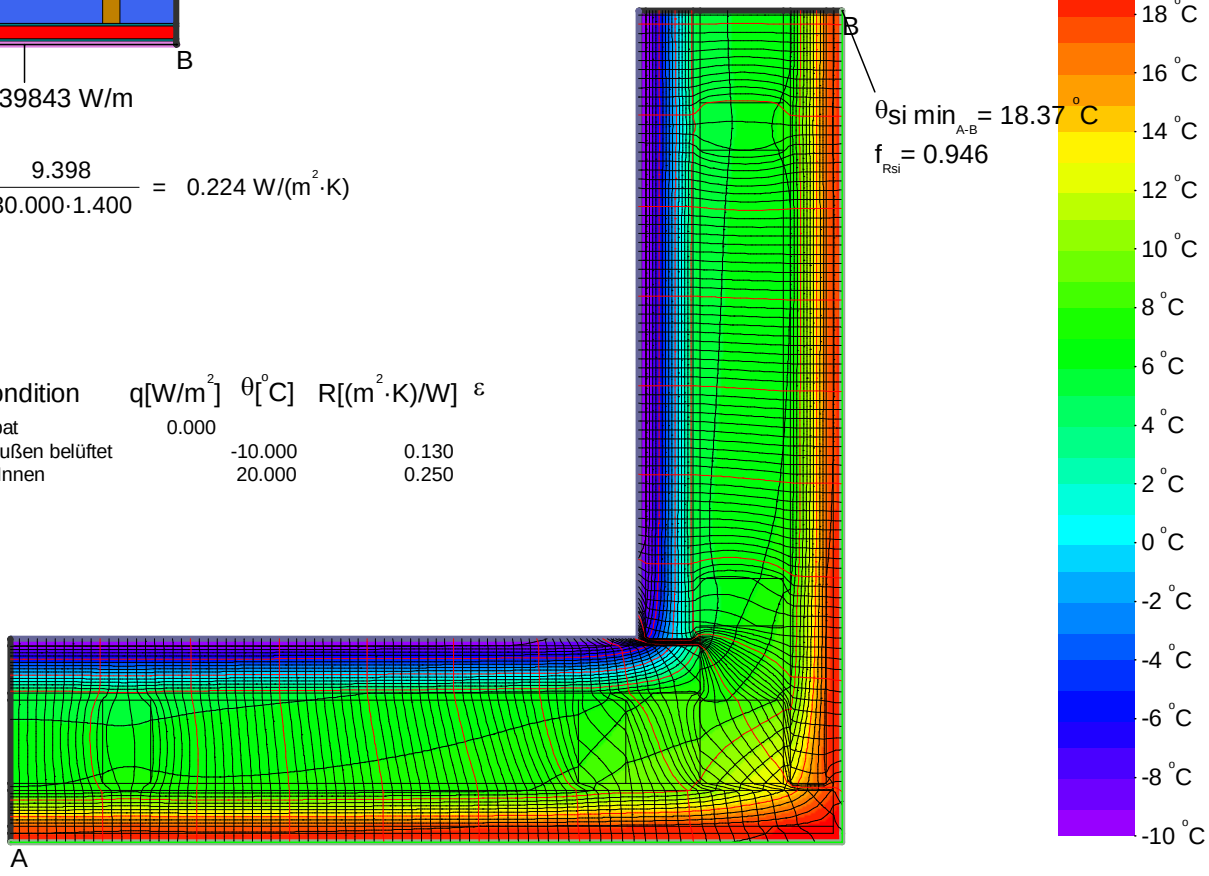


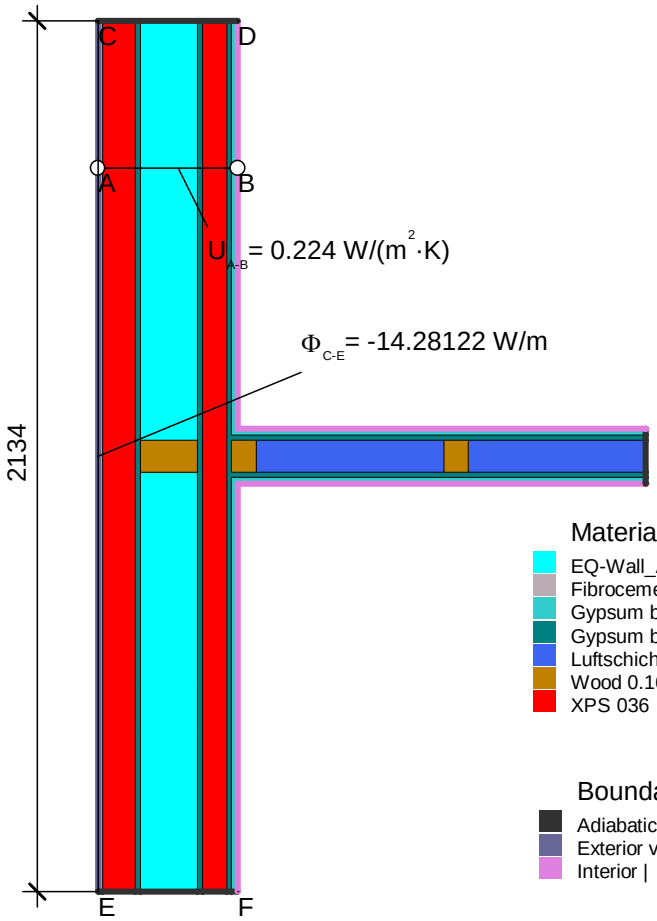
$$\psi_{A\text{-}E\text{-}C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{16.550}{30.000} - 0.224 \cdot 1.058 - 0.224 \cdot 1.058 = 0.078 \text{ W/(m·K)}$$

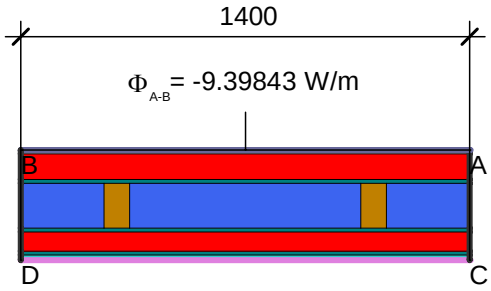


$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.398}{30.000 \cdot 1.400} = 0.224 \text{ W/(m}^2\text{·K)}$$

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
fRsi: Interior I Innen		20.000	0.250	





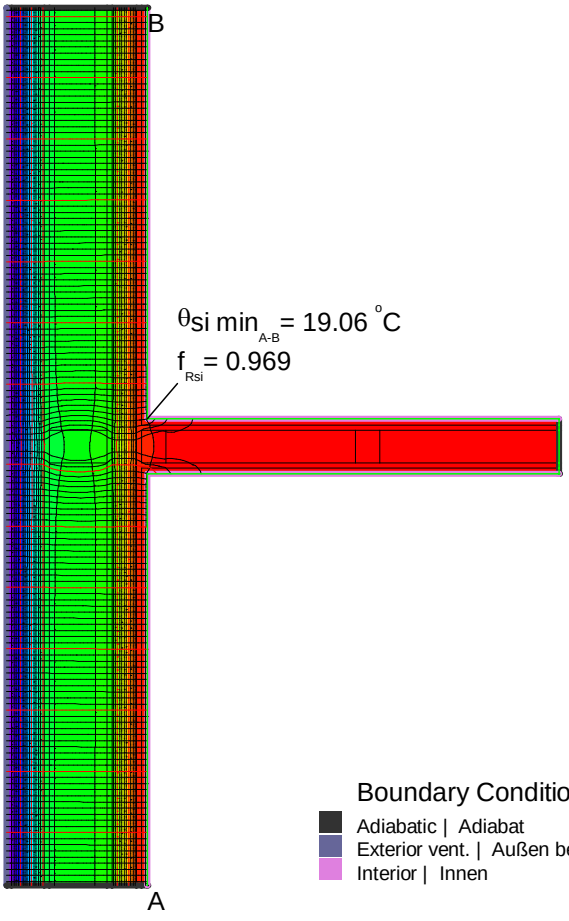


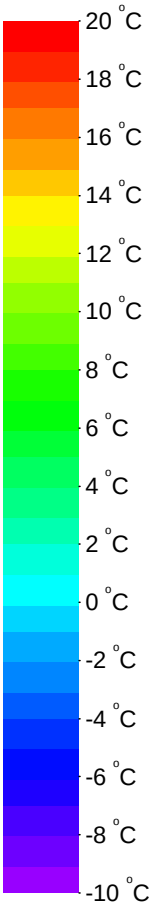
$$U_{eq\ A-B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.398}{30.000 \cdot 1.400} = 0.224\ W/(m^2 \cdot K)$$

Material	λ[W/(m·K)]	ε
EQ-Wall_Air layer + timber	0.666	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Luftschicht, ruhend, horizontal, Dicke: 140 mm (1)	0.778	0.900
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900

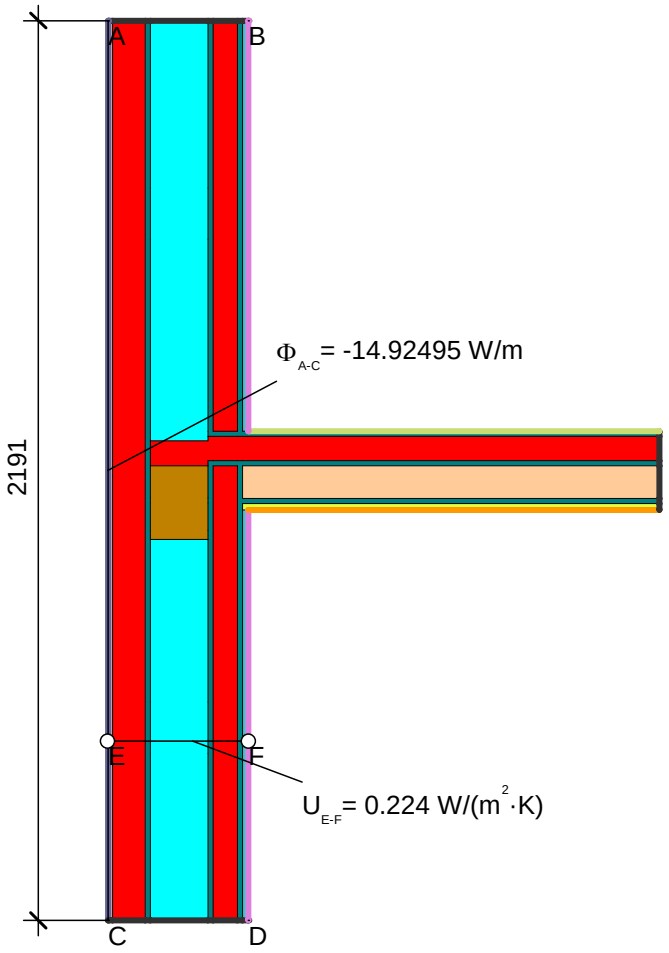
Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Interior | Innen		20.000	0.130	

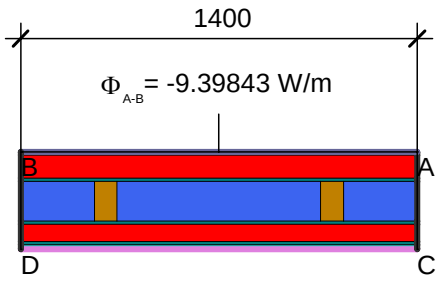
$$\psi_{C-E,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 = \frac{14.281}{30.000} - 0.224 \cdot 2.134 = -0.001\ W/(m \cdot K)$$





Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Interior | Innen		20.000	0.130	



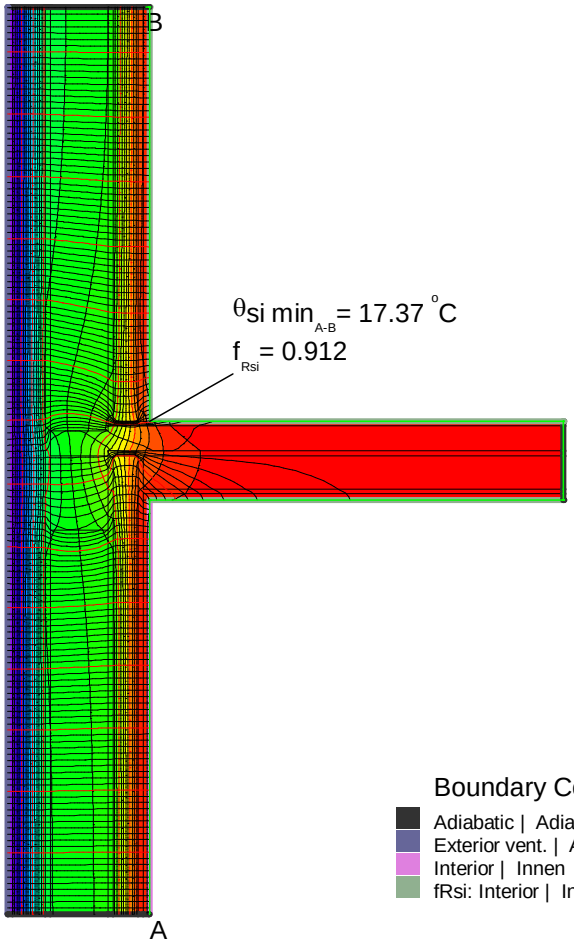


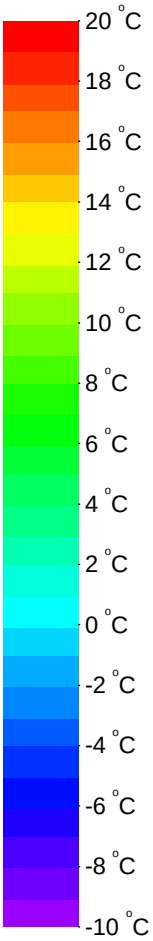
$$U_{eq\ A-B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.398}{30.000 \cdot 1.400} = 0.224\ W/(m^2 \cdot K)$$

Material	λ[W/(m·K)]	ε
EQ-Wall_Air layer + timber	0.666	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board I Gipskartonplatten 900 kg/m3 10456	0.250	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Luftschicht, ruhend, aufwärts, Dicke: 80 mm	0.500	0.900
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Int. flux down I Innen abwärts		20.000	0.170	
Interior I Innen		20.000	0.130	
Interior up. | Innen auf.		20.000	0.100	
Interior | Innen		20.000	0.130	

$$\psi_{A-C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 = \frac{14.925}{30.000} - 0.224 \cdot 2.191 = 0.007\ W/(m \cdot K)$$





Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Interior | Innen		20.000	0.130	
fRsi: Interior | Innen		20.000	0.250	

Certification report | Zertifizierungsbericht

Passive House Institute

Building system
Bausystem

for the warm, temperate climate

für das warm-gemäßigtes Klima

Product I Produkt:	**Thermochip HOUSING SATE-WALL**
Client I Auftraggeber:	**Thermochip SLU**
ıstruction | Konstruktion	**Lightweight timber construction | Holzleichtbau**
Contact person Ansprechpartner Website	Diego Rodriguez +34 681 155 131 www.thermochip.com
Date I Datum: Author I Autor:	**15.09.2020** **M. Arch Soraya López García**

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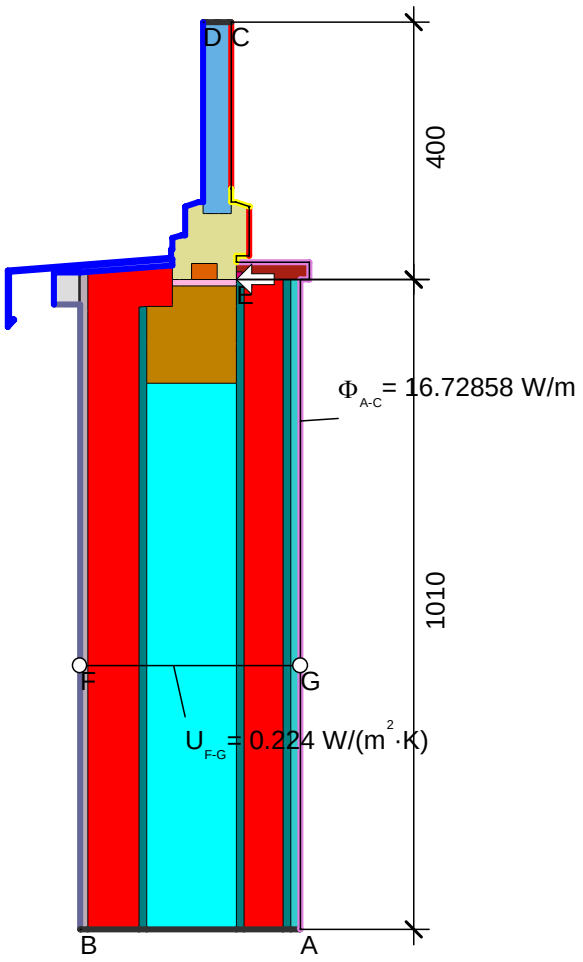
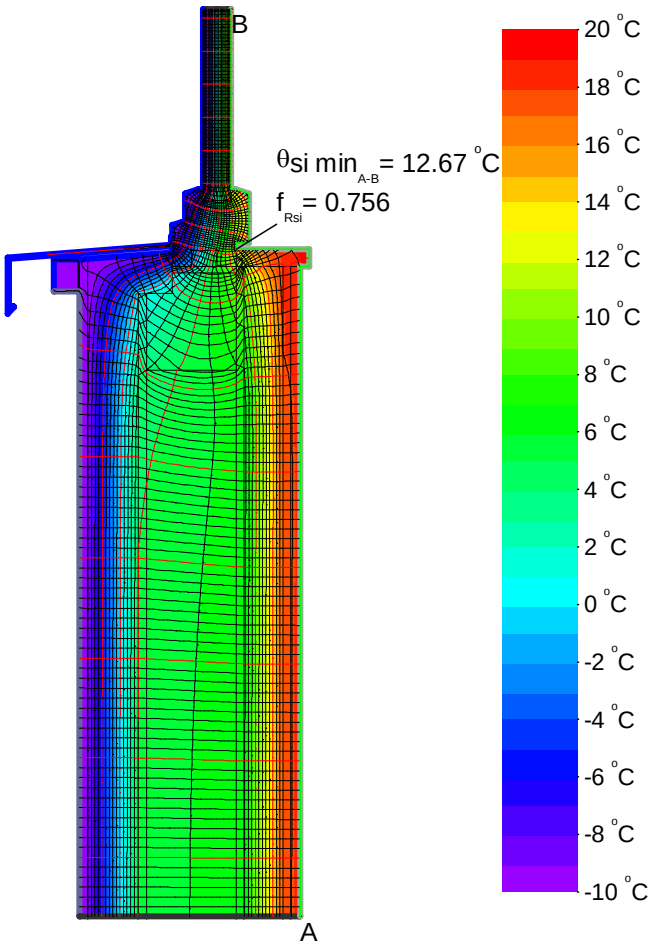
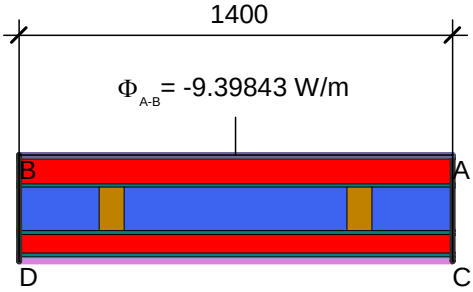




$$\psi_{A\text{-}E\text{-}C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - \frac{\Phi_2}{\Delta T} = \frac{16.729}{30.000} - 0.224 \cdot 1.010 - \frac{9.453}{30.000} = 0.016\ \text{W/(m·K)}$$

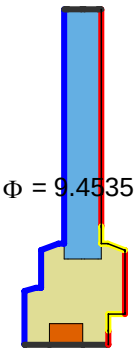
Material	λ[W/(m·K)]	ε
Aluminum I Aluminium 10456	160.000	0.900
EQ-Wall_Air layer + timber	0.666	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Hardwood I Hartholz 0.18 700 kg/m3 10456	0.180	0.900
Insulation I Wärmedämmung 050	0.050	0.900
PU in-situ foam I PU-Ortschaum 040	0.040	0.900
Panel I Maske	0.035	0.900
Silicone I Silikon	0.350	0.900
Softwood, OSB I Weichholz, OSB ISO 10456	0.130	0.900
Unvent. cavity I unbel. Hohlr. *		
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900

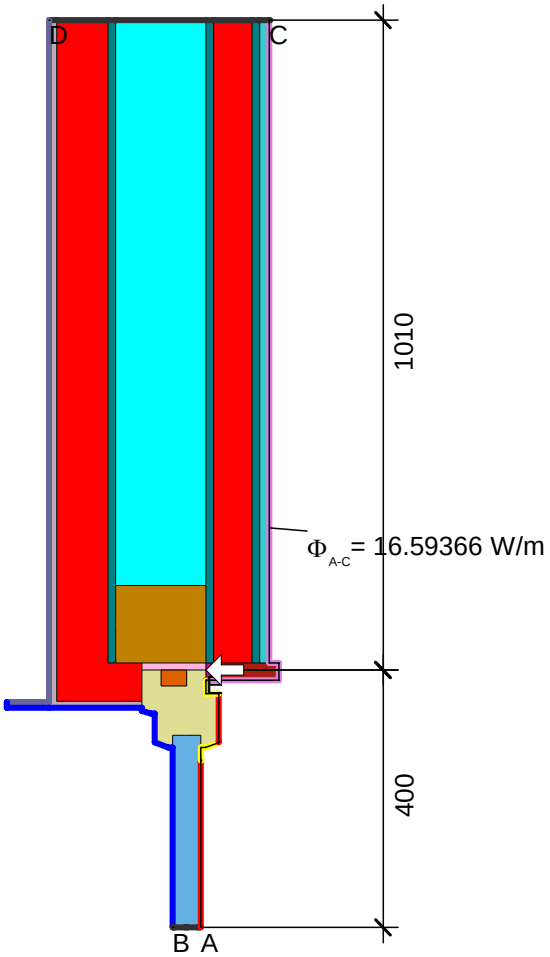
* EN ISO 10077-2:2017, 6.4.3

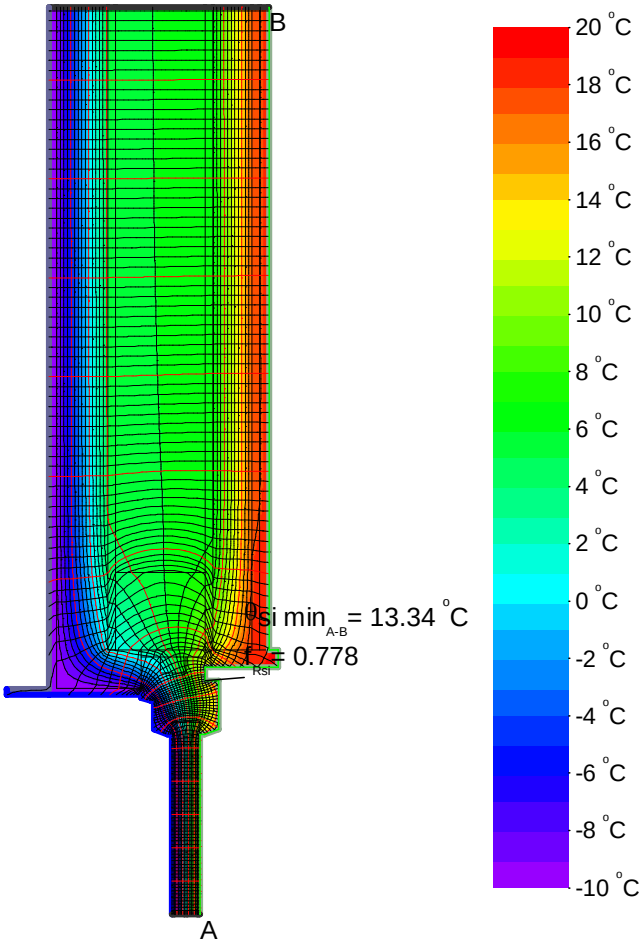


$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.398}{30.000 \cdot 1.400} = 0.224\ \text{W/(m²·K)}$$

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Exterior | Außen		-10.000	0.040	
Innen Fensterrahmen Reduziert		20.000	0.200	
Innen Fensterrahmen Standard		20.000	0.130	
Interior | Innen		20.000	0.130	
e 0,9 Cavity I Hohlraum				0.900

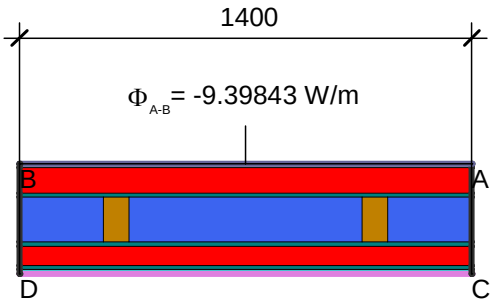






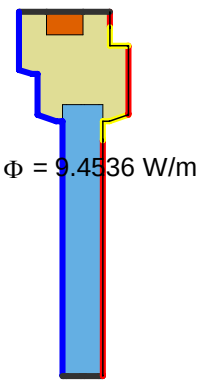
$$\psi_{A\text{-}E\text{-}C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_1}{\Delta T} - U_2 \cdot b_2 = \frac{16.594}{30.000} - \frac{9.454}{30.000} - 0.224 \cdot 1.010 = 0.012 \text{ W/(m·K)}$$

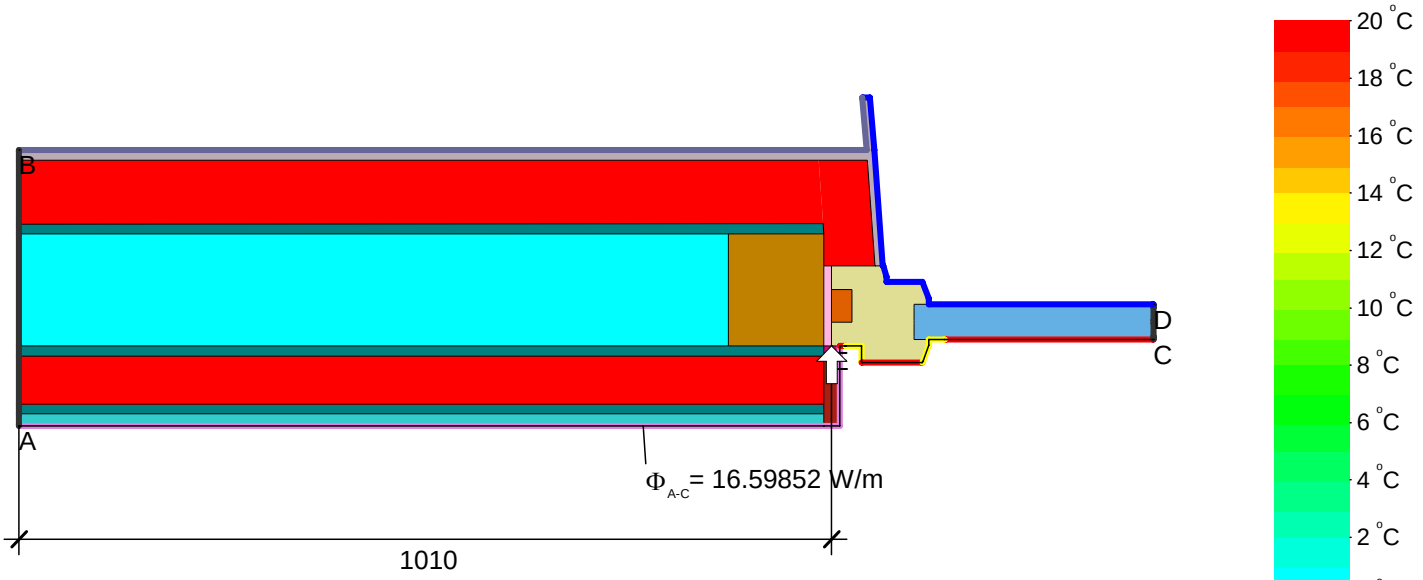
Material	λ[W/(m·K)]	ε
EQ-Wall_Air layer + timber	0.666	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Hardwood I Hartholz 0.18 700 kg/m3 10456	0.180	0.900
Insulation I Wärmedämmung 050	0.050	0.900
PU in-situ foam I PU-Ortschaum 040	0.040	0.900
Panel I Maske	0.035	0.900
Silicone I Silikon	0.350	0.900
Softwood, OSB I Weichholz, OSB ISO 10456	0.130	0.900
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900



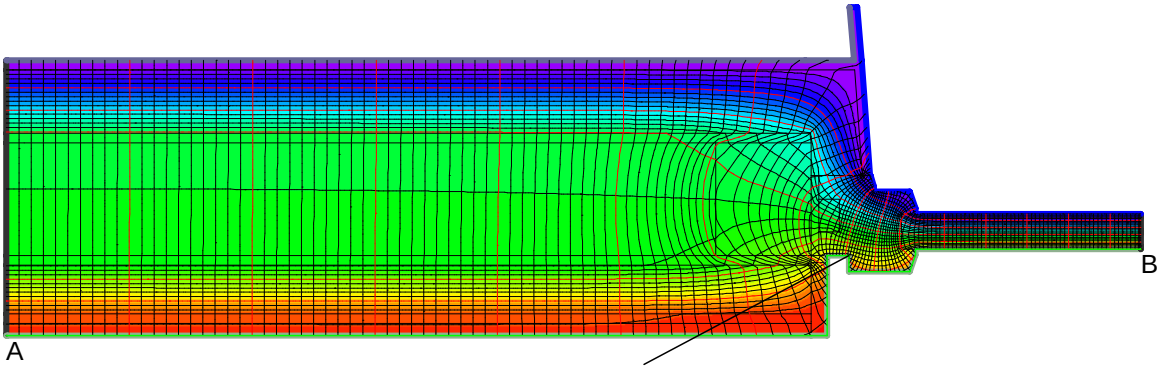
$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.398}{30.000 \cdot 1.400} = 0.224 \text{ W/(m}^2\text{·K)}$$

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Aussen Standard		-10.000	0.040	
Exterior vent. | Außen belüftet		-10.000	0.130	
Innen Fensterrahmen Reduziert		20.000	0.200	
Innen Fensterrahmen Standard		20.000	0.130	
Interior I Innen		20.000	0.130	



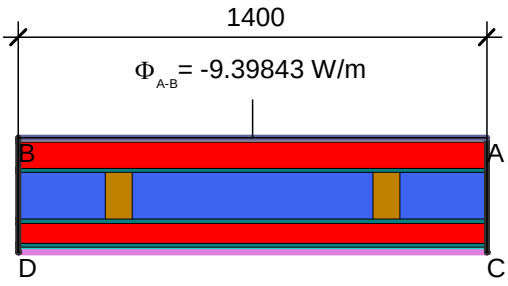


$$\psi_{A\text{-}E\text{-}C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - \frac{\Phi_2}{\Delta T} = \frac{16.599}{30.000} - 0.224 \cdot 1.010 - \frac{9.454}{30.000} = 0.012 \text{ W/(m·K)}$$



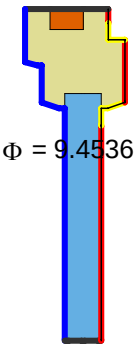
$\theta si\ min_{A\text{-}B} = 13.47\ ^{\circ}C$

$f_{Rsi} = 0.782$



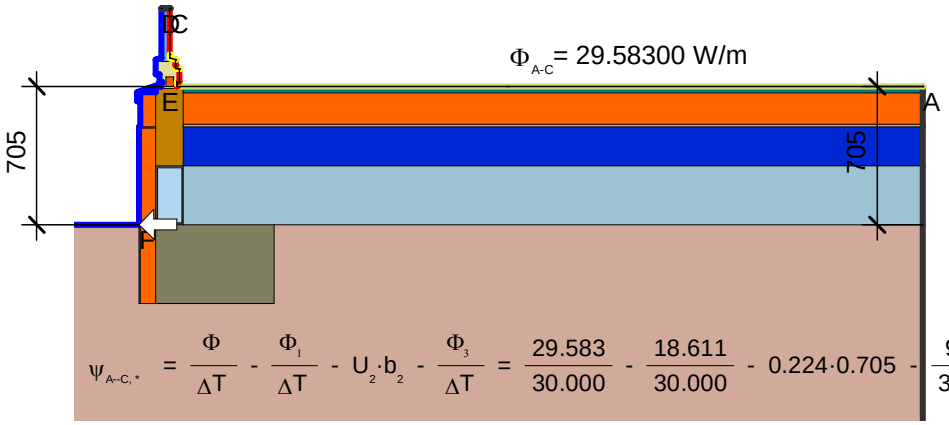
$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.398}{30.000 \cdot 1.400} = 0.224 \text{ W/(m}^2\text{·K)}$$

Material	λ[W/(m·K)]	ε
EQ-Wall_Air layer + timber	0.666	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Hardwood I Hartholz 0.18 700 kg/m3 10456	0.180	0.900
Insulation I Wärmedämmung 050	0.050	0.900
PU in-situ foam I PU-Ortschaum 040	0.040	0.900
Panel I Maske	0.035	0.900
Silicone I Silikon	0.350	0.900
Softwood, OSB I Weichholz, OSB ISO 10456	0.130	0.900
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900



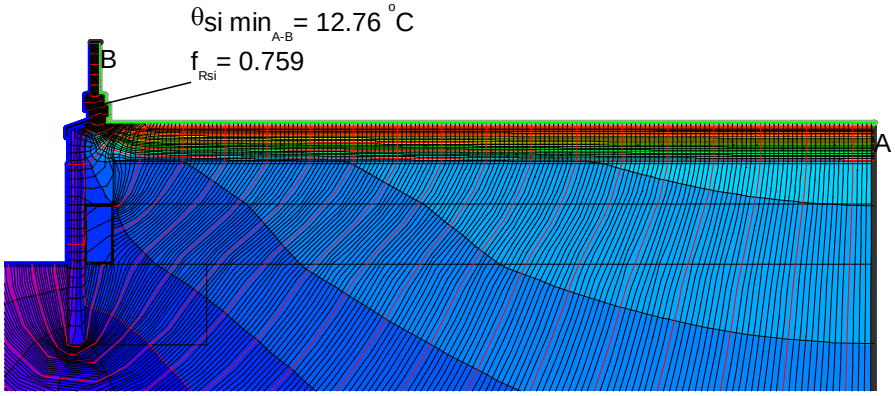
Φ = 9.4536 W/m

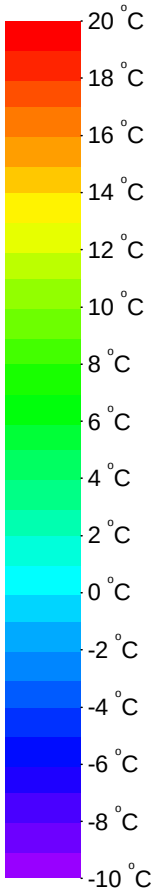
Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Exterior | Außen		-10.000	0.040	
Innen Fensterrahmen Reduziert		20.000	0.200	
Innen Fensterrahmen Standard		20.000	0.130	
Interior I Innen		20.000	0.130	

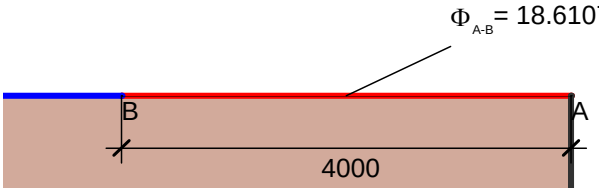


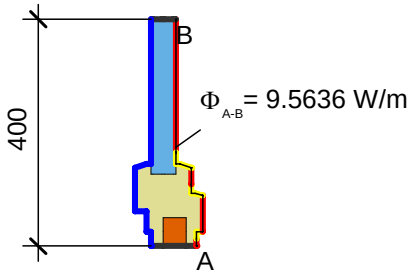
$$\psi_{A-C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_1}{\Delta T} - U_2 \cdot b_2 - \frac{\Phi_3}{\Delta T} = \frac{29.583}{30.000} - \frac{18.611}{30.000} - 0.224 \cdot 0.705 - \frac{9.564}{30.000} = -0.111 \text{ W/(m·K)}$$

$$\Psi_{WITH} = \Psi_{FSEW+WITH} - \Psi_{FSEW01} = -0.111 - (-0.149) = 0.038 \text{ W/mK}$$

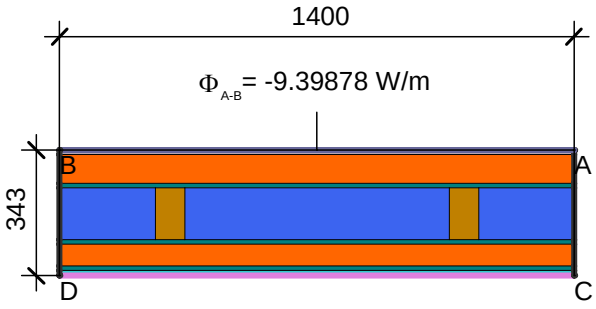








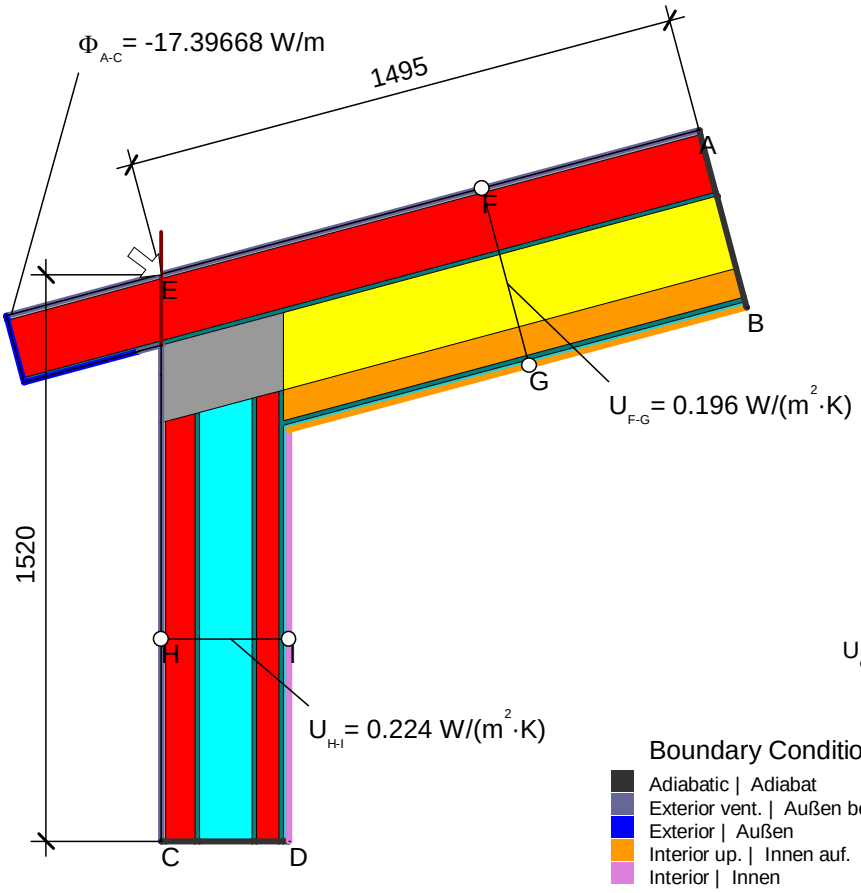
Material	λ[W/(m·K)]	ε
Aluminum I Aluminium 10456	160.000	0.900
Concrete, 1% Steel I Beton, 1% Stahl ISO 10456	2.300	0.900
EPDM	0.250	0.900
Fibrocemento | Fiber cement	1.200	0.900
Ground I Erdreich	2.000	0.900
Gypsum board with cellulose fibres	0.669	0.900
Insulation I Wärmedämmung 050	0.050	0.900
Luftschicht, ruhend, horizontal, Dicke: 280 mm	1.556	0.900
Luftschicht, schwach belüftet, aufwärts, Dicke: 200 mm	2.500	0.900
Luftschicht, schwach belüftet, aufwärts, Dicke: 300 mm	3.750	0.900
PU in-situ foam I PU-Ortschaum 040	0.040	0.900
Panel I Maske	0.035	0.900
Softwood, OSB I Weichholz, OSB ISO 10456	0.130	0.900
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900

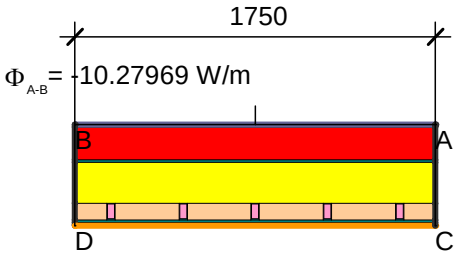


Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior | Außen		-10.000	0.040	
Int. flux down I Innen abwärts		20.000	0.170	
Interior, frame, normal		20.000	0.130	
Interior, frame, reduced		20.000	0.200	

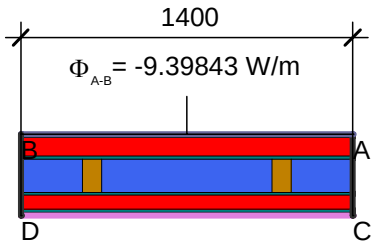
$$U_{eq\ A-B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.399}{30.000 \cdot 1.400} = 0.224 \text{ W/(m}^2\text{·K)}$$

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior | Außen		-10.000	0.040	
fRsi: Interior I Innen		20.000	0.250	





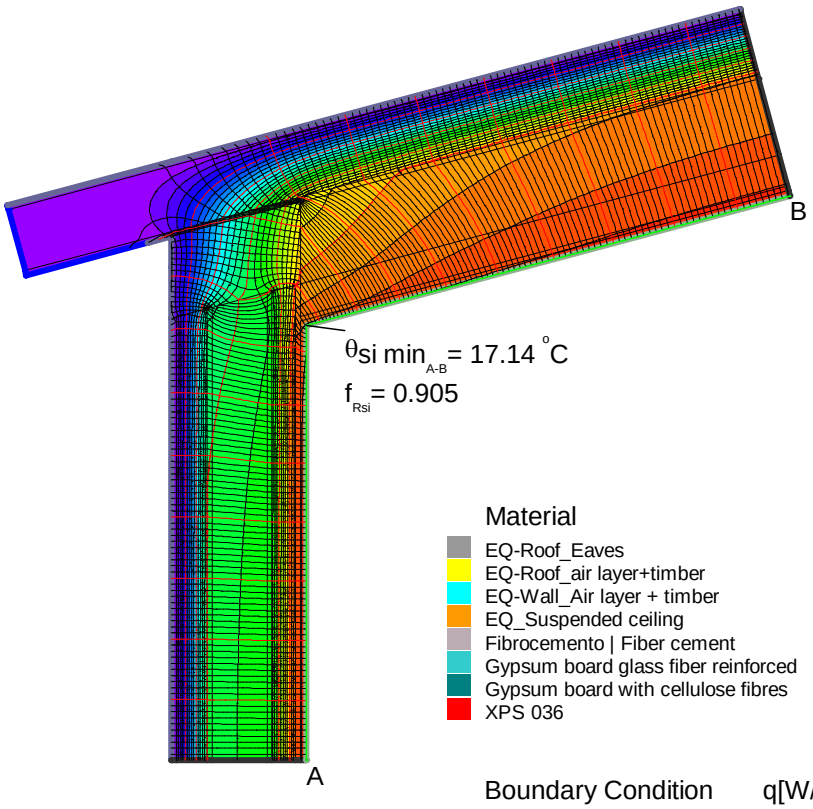
$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{10.280}{30.000 \cdot 1.750} = 0.196\ W/(m^2 \cdot K)$$

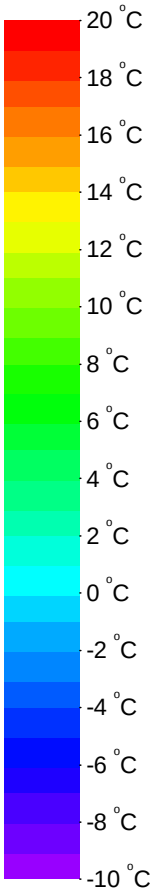


$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.398}{30.000 \cdot 1.400} = 0.224\ W/(m^2 \cdot K)$$

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Exterior | Außen		-10.000	0.040	
Interior up. | Innen auf.		20.000	0.100	
Interior | Innen		20.000	0.130	

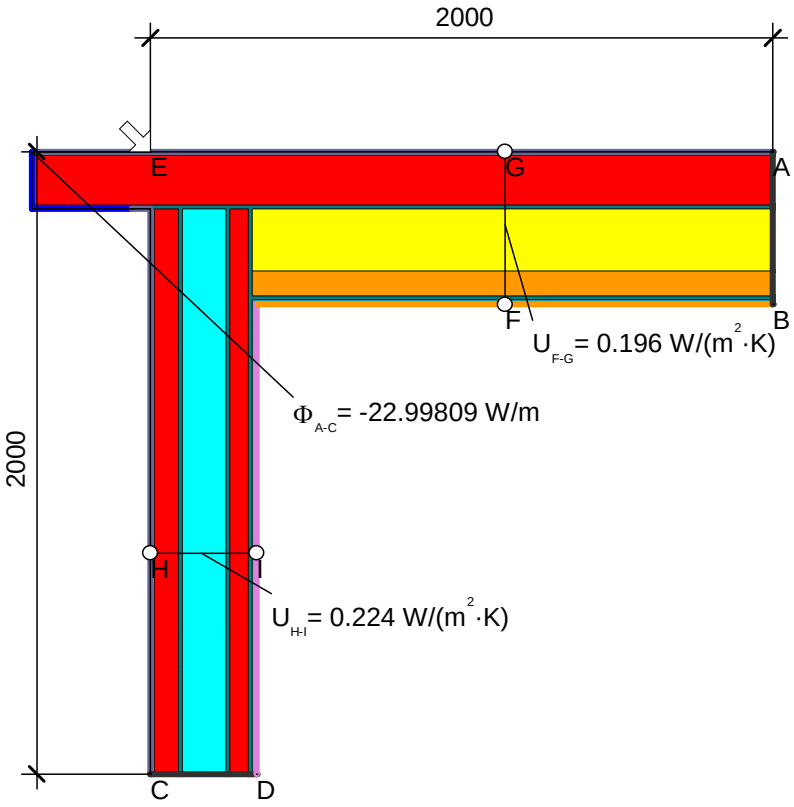
$$\psi_{A\text{-}E\text{-}C,\ *} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{17.397}{30.000} - 0.196 \cdot 1.495 - 0.224 \cdot 1.520 = -0.053\ W/(m \cdot K)$$

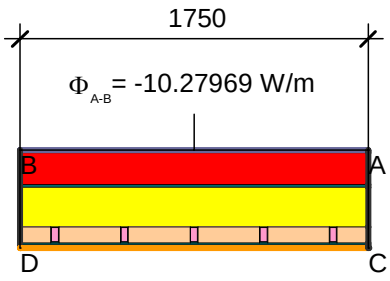




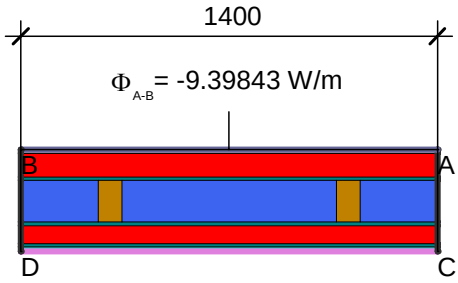
Material	λ[W/(m·K)]	ε
EQ-Roof_Eaves	0.080	0.900
EQ-Roof_air layer+timber	0.920	0.900
EQ-Wall_Air layer + timber	0.666	0.900
EQ_Suspended ceiling	0.710	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
XPS 036	0.036	0.900

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Exterior | Außen		-10.000	0.040	
fRsi: Interior | Innen		20.000	0.250	





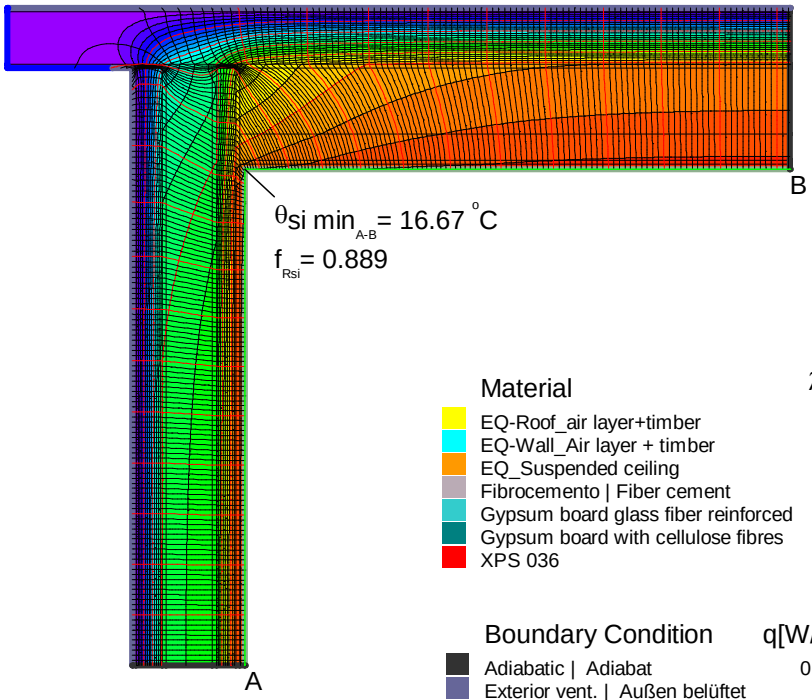
$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{10.280}{30.000 \cdot 1.750} = 0.196\ W/(m^2 \cdot K)$$



$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.398}{30.000 \cdot 1.400} = 0.224\ W/(m^2 \cdot K)$$

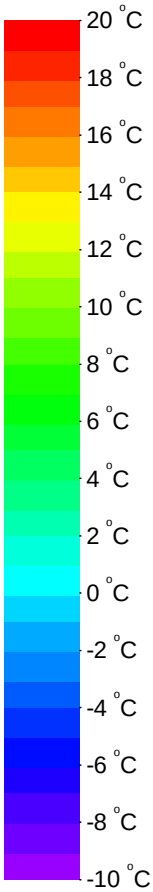
$$\Psi_{A\text{-}E\text{-}C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{22.998}{30.000} - 0.196 \cdot 2.000 - 0.224 \cdot 2.000 = -0.073\ W/(m \cdot K)$$

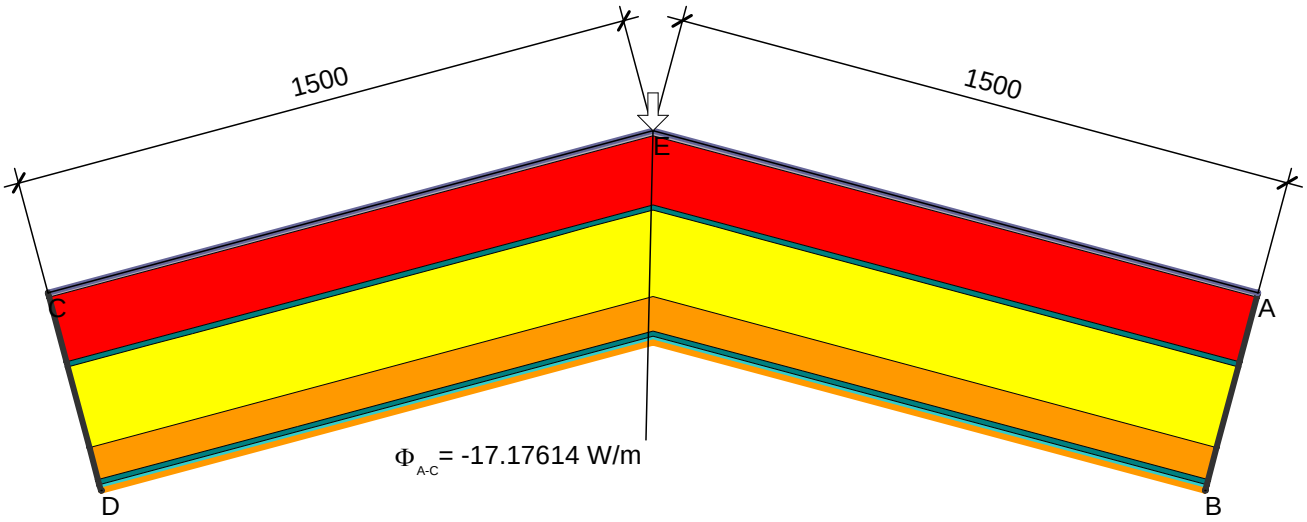
Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Exterior | Außen		-10.000	0.040	
Interior up. | Innen auf.		20.000	0.100	
Interior | Innen		20.000	0.130	



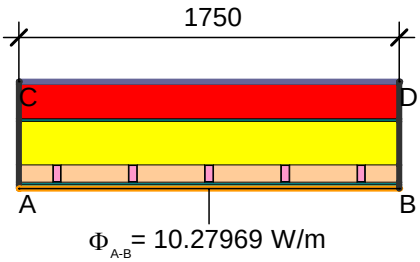
Material	λ[W/(m·K)]	ε
EQ-Roof_air layer+timber	0.920	0.900
EQ-Wall_Air layer + timber	0.666	0.900
EQ_Suspended ceiling	0.710	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
XPS 036	0.036	0.900

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Exterior | Außen		-10.000	0.040	
fRsi: Interior | Innen		20.000	0.250	





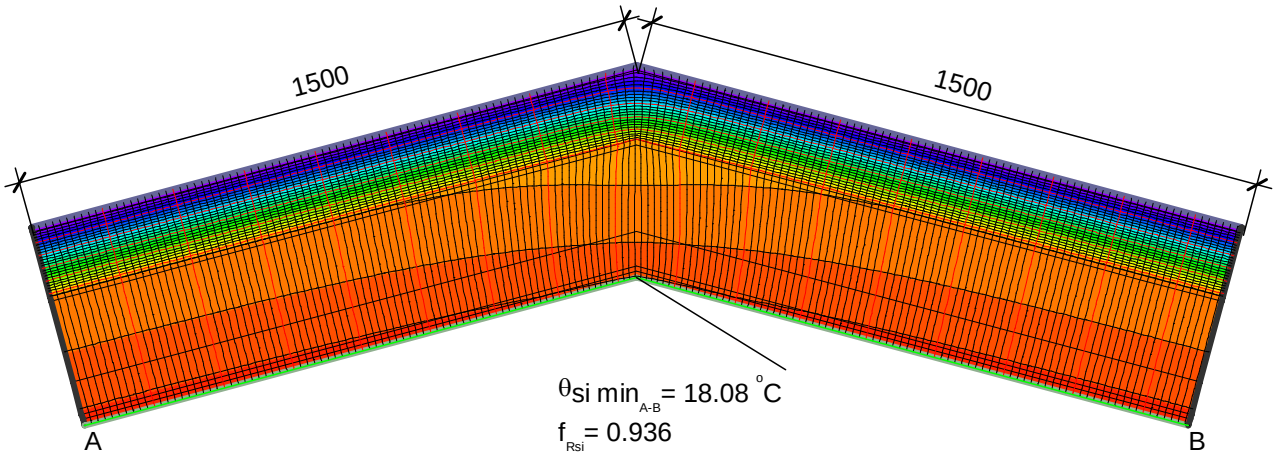
$$\psi_{A\text{-}E\text{-}C,\,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{17.176}{30.000} - 0.196 \cdot 1.500 - 0.196 \cdot 1.500 = -0.015\ \text{W/(m·K)}$$

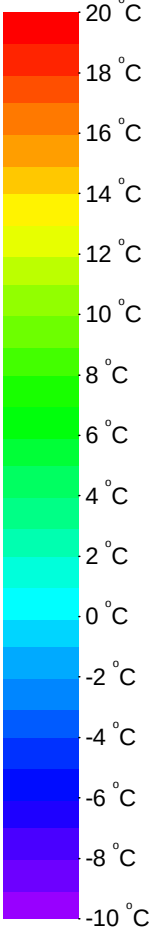


Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Interior up. | Innen auf.		20.000	0.100	

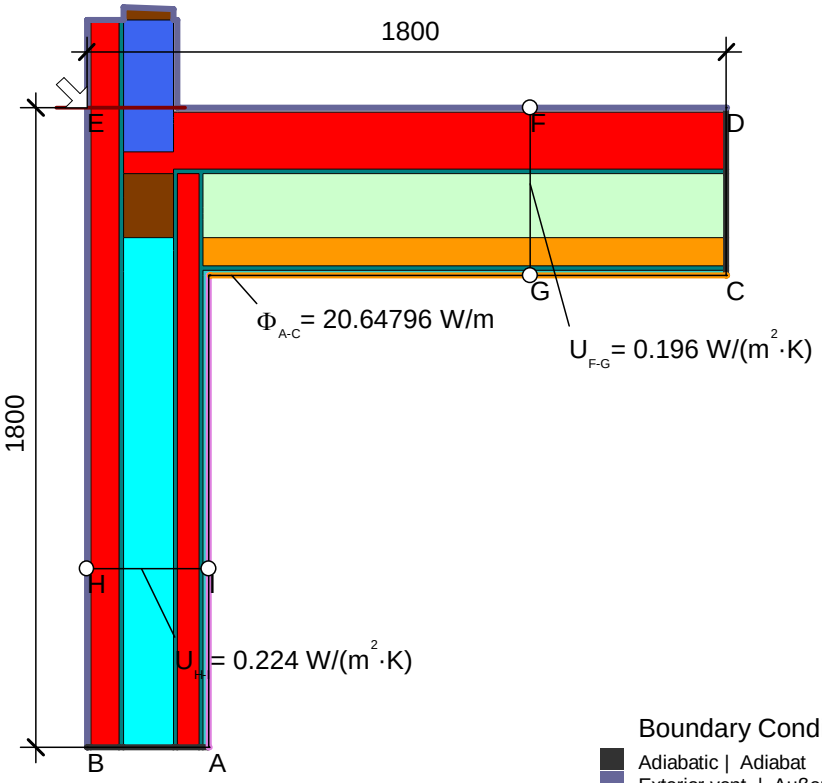
Material	λ[W/(m·K)]	ε
EQ-Roof_air layer+timber	0.920	0.900
EQ_Suspended ceiling	0.710	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
XPS 036	0.036	0.900

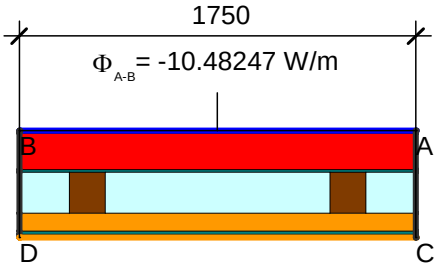
$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{10.280}{30.000 \cdot 1.750} = 0.196\ \text{W/(m²·K)}$$



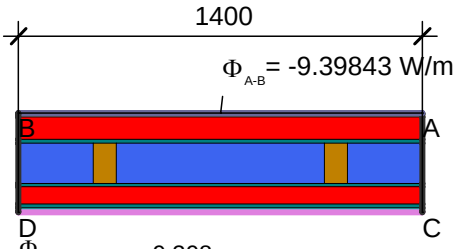


Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
fRsi: Interior | Innen		20.000	0.250	





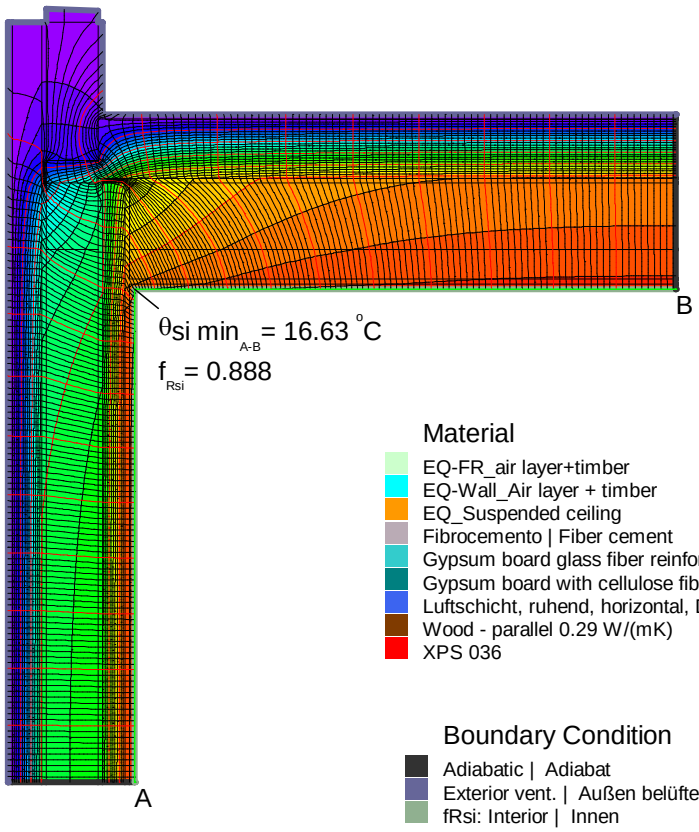
$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{10.482}{30.000 \cdot 1.750} = 0.200\ W/(m^2 \cdot K)$$



$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.398}{30.000 \cdot 1.400} = 0.224\ W/(m^2 \cdot K)$$

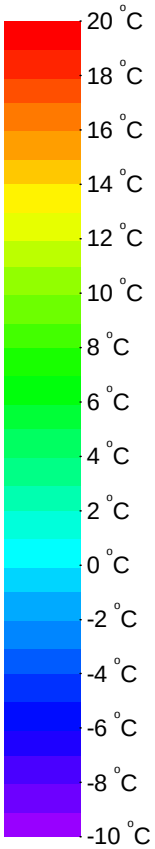
Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
Interior I Innen		20.000	0.130	
Interior up. | Innen auf.		20.000	0.100	

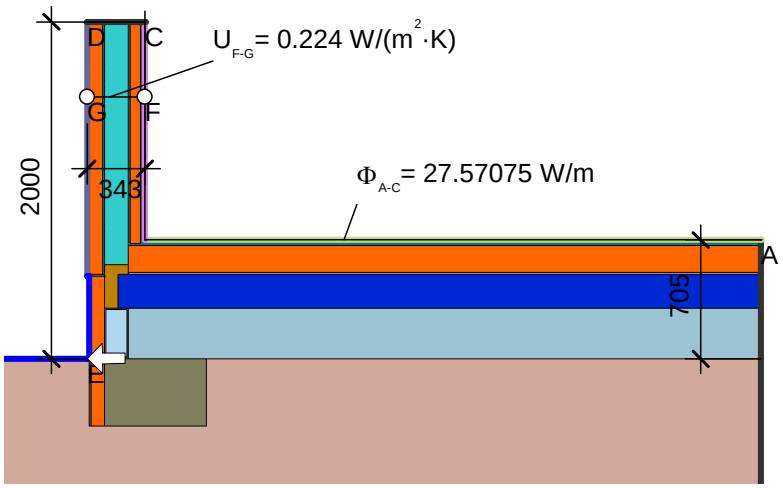
$$\psi_{A\text{-}E\text{-}C,\ *} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{20.648}{30.000} - 0.224 \cdot 1.800 - 0.200 \cdot 1.800 = -0.074\ W/(m \cdot K)$$

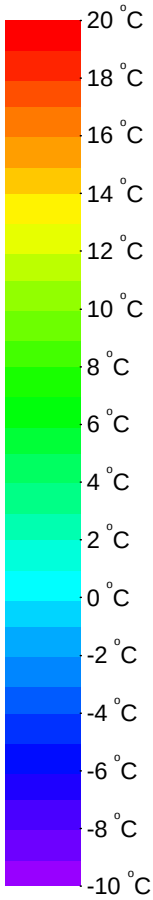


Material	λ[W/(m·K)]	ε
EQ-FR_air layer+timber	0.900	0.900
EQ-Wall_Air layer + timber	0.666	0.900
EQ_Suspended ceiling	0.710	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Luftschicht, ruhend, horizontal, Dicke: 140 mm (1)	0.778	0.900
Wood - parallel 0.29 W/(mK)	0.290	0.900
XPS 036	0.036	0.900

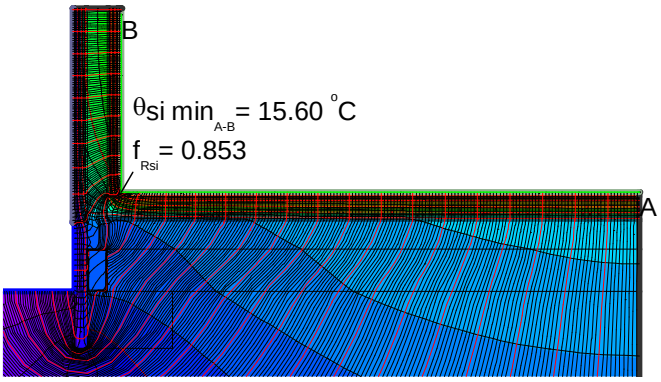
Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic | Adiabat	0.000			
Exterior vent. | Außen belüftet		-10.000	0.130	
fRsi: Interior | Innen		20.000	0.250	

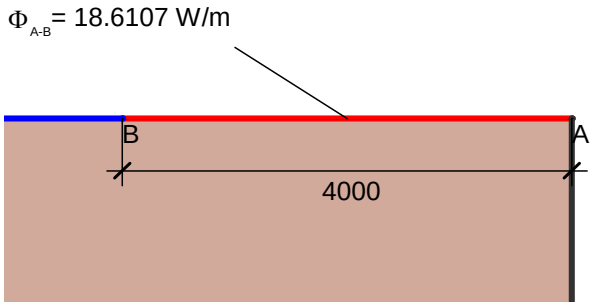




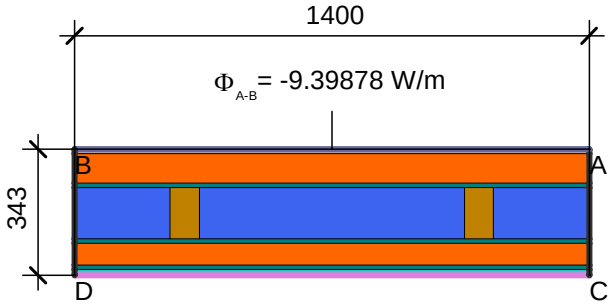


$$\psi_{A\text{-}E\text{-}C,\,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_I}{\Delta T} - U_2 \cdot b_2 = \frac{27.571}{30.000} - \frac{18.611}{30.000} - 0.224 \cdot 2.000 = -0.149 \text{ W/(m·K)}$$





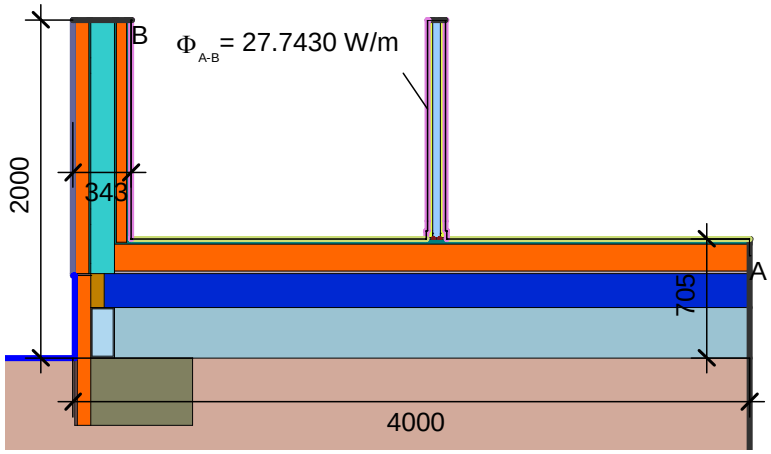
Material	λ[W/(m·K)]	ε
Aluminum I Aluminium 10456	160.000	0.900
Concrete, 1% Steel I Beton, 1% Stahl ISO 10456	2.300	0.900
EPDM	0.250	0.900
EQ-Wall_Air layer + timber	0.656	0.900
Fibrocemento | Fiber cement	1.200	0.900
Ground I Erdreich	2.000	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Luftschicht, ruhend, horizontal, Dicke: 280 mm	1.556	0.900
Luftschicht, schwach belüftet, aufwärts, Dicke: 200 mm	2.500	0.900
Luftschicht, schwach belüftet, aufwärts, Dicke: 300 mm	3.750	0.900
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900



Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic	0.000			
Adiabatic | Adiabat	0.000			
Exterior I Außen		-10.000	0.040	
Exterior vent. | Außen belüftet		-10.000	0.130	
Int. flux down I Innen abwärts		20.000	0.170	
Interior I Innen		20.000	0.130	

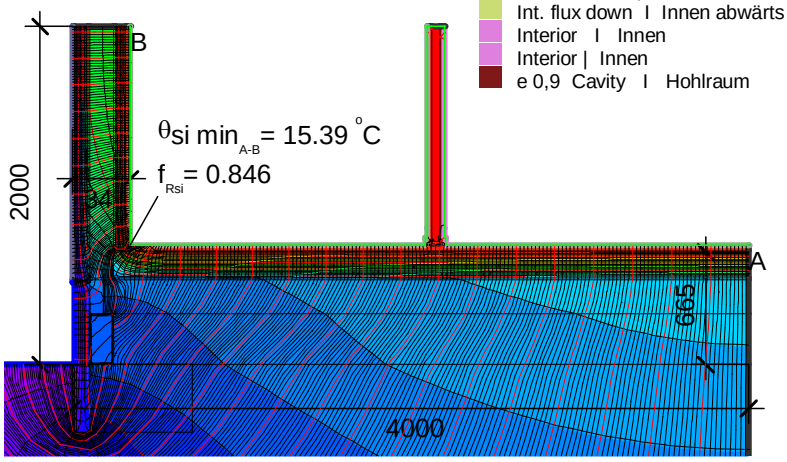
$$U_{eq\ A\text{-}B} = \frac{\Phi}{\Delta T \cdot b} = \frac{9.399}{30.000 \cdot 1.400} = 0.224 \text{ W/(m}^2\text{·K)}$$

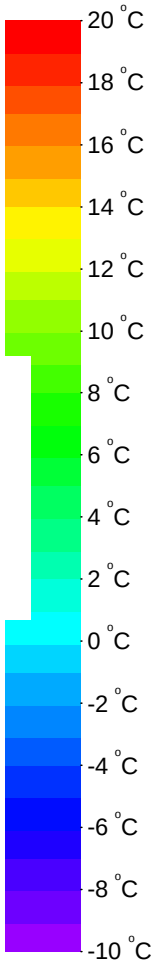
Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic	0.000			
Adiabatic | Adiabat	0.000			
Exterior I Außen		-10.000	0.040	
Exterior vent. | Außen belüftet		-10.000	0.130	
fRsi: Interior I Innen		20.000	0.250	

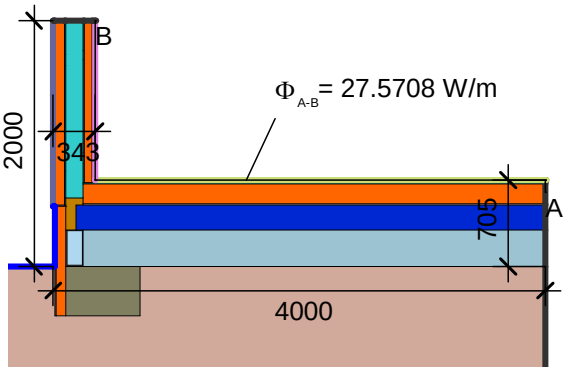


$\Psi_{FSIW} = (Q_{FSIW} - Q_{FSEW}) / \Delta T = (27.7430 - 27.5708) / 30 = 0{,}006$ W/mK

Boundary Condition	q[W/m²]	θ[°C]	R[(m²·K)/W]	ε
Adiabatic I Adiabatisch	0.000			
Adiabatic | Adiabat	0.000			
Exterior I Außen		-10.000	0.040	
Exterior vent. | Außen belüftet		-10.000	0.130	
Int. flux down I Innen abwärts		20.000	0.170	
Interior I Innen		20.000	0.130	
Interior | Innen		20.000	0.130	
e 0,9 Cavity I Hohlraum				0.900







Material	λ[W/(m·K)]	ε
Aluminum I Aluminium 10456	160.000	0.900
Concrete, 1% Steel I Beton, 1% Stahl ISO 10456	2.300	0.900
EPDM	0.250	0.900
EQ-Wall_Air layer + timber	0.656	0.900
Eq_1 Service Cavity	0.046	0.900
Fibrocemento | Fiber cement	1.200	0.900
Gips 1500 kg/m3	0.560	0.900
Ground I Erdreich	2.000	0.900
Gypsum board I Gipskartonplatten 900 kg/m3 10456	0.250	0.900
Gypsum board glass fiber reinforced	0.250	0.900
Gypsum board with cellulose fibres	0.669	0.900
Knauf Ultracoustic Suelo TP 037 +10%	0.041	0.900
Luftschicht, ruhend, horizontal, Dicke: 280 mm	1.556	0.900
Luftschicht, schwach belüftet, aufwärts, Dicke: 200 mm	2.500	0.900
Luftschicht, schwach belüftet, aufwärts, Dicke: 300 mm	3.750	0.900
Polyethylenschaum	0.050	0.900
Steel I Stahl	50.000	0.900
Unvent. cavity I unbel. Hohlr. *		
Wood 0.16 W/(mK)	0.160	0.900
XPS 036	0.036	0.900

* EN ISO 10077-2:2017, 6.4.3