



## Report - Certified Passive House Component | Bericht - Zertifizierte Passivhaus Komponente

Passive House Institute

Recommended for | Empfohlen für  
Cool-temperate climate | kühl-gemäßiges Klima



**Doorsystem**  
**Türsystem**

Passive House Institute  
Rheinstraße 44/46  
64283 Darmstadt  
GERMANY

+49.6151.82699.0

mail@passiv.de  
www.passiv.de

Product | Produkt:

**Wood Entry Door (Glazed)**  
1242ds03

Client | Auftraggeber:

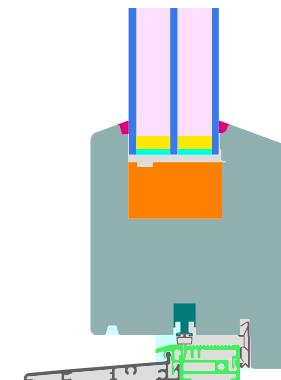
**Wescon Cedar Products Ltd.**

Date | Datum:

**27.09.2018**

Author | Autor:

**M. Arch. Edward Lowes**



Because a separate heating system is not necessarily required in Passive Houses, high demands are placed on the quality of the building components used. The colder the climate, the higher the requirements for the components. To cover this, PHI has identified regions of similar requirements, and defined certification criteria. These criteria are available for free download at the website of the Passive House Institute.

Passivhäuser stellen aufgrund der Möglichkeit, auf ein separates Heizsystem zu verzichten, hohe Anforderungen an die Qualität der verwendeten Bauteile. Dabei steigen die Anforderungen, je kälter das Klima ist. Darum hat das Passivhaus Institut Regionen gleicher Anforderung identifiziert und für diese Zertifizierungskriterien festgelegt. Die Kriterien sind auf der Homepage des Passivhaus Instituts als kostenfreier Download verfügbar.

Wird keine gezielte Heizwärmezufuhr unter den Fenstern vorgesehen, darf der Wärmedurchgangskoeffizient der

If no radiator is placed under the window, its thermal transmittance  $U_w$  (U-value) may not exceed a climate-dependent value in order to prevent unpleasant radiation losses and cold down droughts. For a given quality of glazing, this results in restriction of the thermal losses of the window frame and the glass edge. In that context, the installation situation of the window in the wall is relevant. Because of that, a  $U_{w,\text{installed}}$  exemplary tested for the certification has been defined.

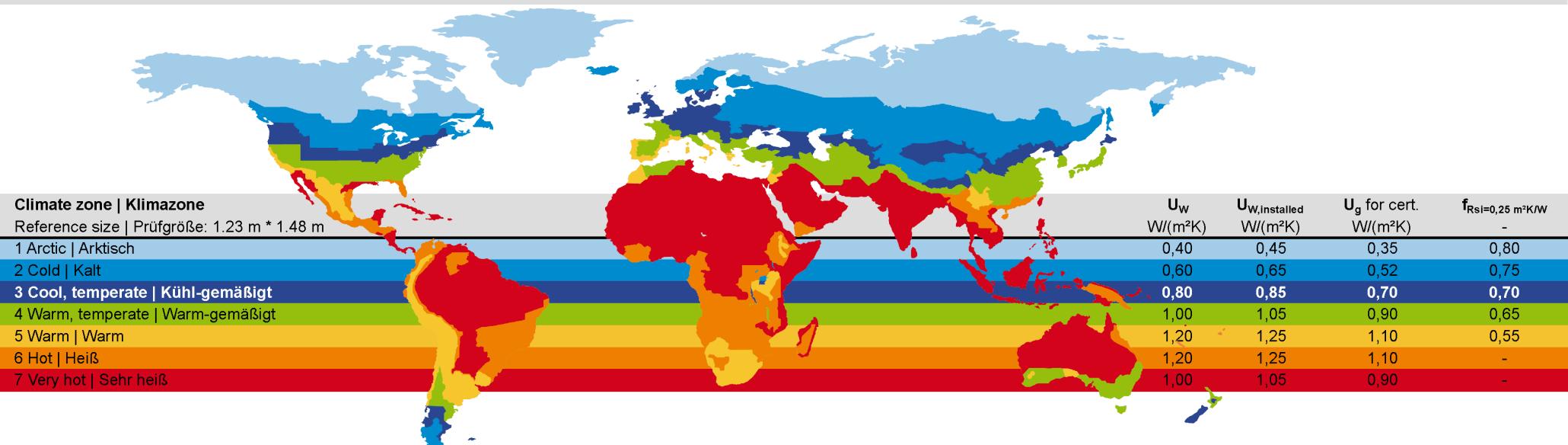
verwendeten Fenster (Fenster-U-Wert)  $U_w$  einen vom Klima abhängigen Höchstwert nicht überschreiten, damit es nicht zu störendem Strahlungswärmeentzug und Kaltluftabfall am Fenster kommt. Daraus ergeben sich bei gegebener Verglasungsqualität Grenzen für den Wärmeverlust im Bereich des Fensterrahmens. In diesem Kontext ist die Einbausituation des Fensters relevant. Darum wurde auch für  $U_{w,\text{eingebaut}}$  ein Maximalwert festgelegt, der im Rahmen der Zertifizierung beispielhaft geprüft wurde.

Also the hygiene criterion must be met. For reasons of hygiene, this criterion limits the minimum individual temperature on window surfaces to prevent condensate and mold growth.

The below stated requirements for awarding the label "Certified Passive House Component" have been set by the Passive House Institute (PHI).

Des Weiteren ist das Hygienekriterium zu erfüllen. Dieses Kriterium begrenzt die minimale Einzeltemperatur an der Innenseite der Fensteroberfläche, um Tauwasserausfall und Schimmelbildung zu vermeiden.

Durch das Passivhaus Institut (PHI) wurden die unten stehenden Anforderungen zum Erlangen der Auszeichnung "Zertifizierte Passivhaus Komponente" festgesetzt.



The simulation of the thermal values of the frame sections are based on the regulations of the standard ISO 10077-1:2010 and 10077-2:2012. The thermal conductivities of the used materials refer to relevant standards, technical approvals or have been determined by measured values according to ISO 10077-2:2012, chapter 5.1. In case of one glazing, the models are to 40 cm height, in case of 2 glazing 60 cm in height.

The **spacers** were modeled according to the actual 2-Box-models of the working group "Warm Edge" of

the Federal glass association (Bundesverband Flachglas) of Germany. Thermal bridge coefficients were calculated for typical **installation situations**. These values may be used in case of identical installations only in energy balance calculations. The wall-models are 1.41 m in height, glass and frame are 40 cm height, the installation gap is 1 cm.

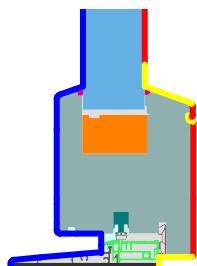
For modeling and simulations, the software Flixo 7 of Infomind was used. For the used **boundary conditions**, please have a look at following drawings and tables.

Die **Berechnung der thermischen Kennwerte** der Rahmenschnitte erfolgte auf der Grundlage der ISO 10077-1:2010 und 10077-2:2012. Die Wärmeleitfähigkeiten stammen aus einschlägigen Normen, bauaufstichtlichen Zulassungen oder wurden anhand von messwerten nach den Regeln der ISO 10077-2:2012 Abschnitt 5.1 determiniert. Dabei sind die Modelle mit einem Glasteil stets 40 cm, Modelle mit 2 Glasteilen stets 60 cm hoch.

Zur Abbildung der **Abstandhalter** wurde auf die jeweils aktuellen 2-Box-Modelle des Arbeitskreises Warme Kante des Bundesverbandes Flachglas zurückgegriffen.

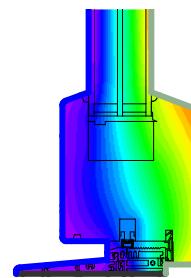
Die **Wärmebrückenverlustkoeffizienten** wurden beispielhaft für typische **Wandaufbauten** berechnet. Diese dürfen in der Gebäudeenergiebilanzierung nur bei identischer Konstruktion zum Ansatz gebracht werden. Die Modelle für Wandaufbauten sind stets 1,41 m hoch, wobei die Höhe des Glases und Rahmens 40 cm beträgt. Es wird eine Einbaufuge von 1 cm angesetzt.

Zur Berechnung der Bildung der Modelle und zur Berechnung der Wärmeströme wurde das Programm Flixo 7 Professional der Firma Infomind genutzt. Die Randbedingungen wurden wie unten gezeigt angesetzt.



Randbedingung
Adiabatic   Adiabatisch
Exterior   Außen
Interior, frame, normal
Interior, frame, reduced
e 0,9 Cavity   Hohlraum

	$q[W/m^2]$	$\theta[^\circ C]$	$R[(m^2 \cdot K)/W]$	$\epsilon$
	0,000			
Exterior   Außen	-10,000		0,040	
Interior, frame, normal	20,000		0,130	
Interior, frame, reduced	20,000		0,200	
e 0,9 Cavity   Hohlraum			0,900	



Randbedingung
Adiabatic   Adiabatisch
Exterior   Außen
e 0,9 Cavity   Hohlraum
fRsi: Interior   Innen

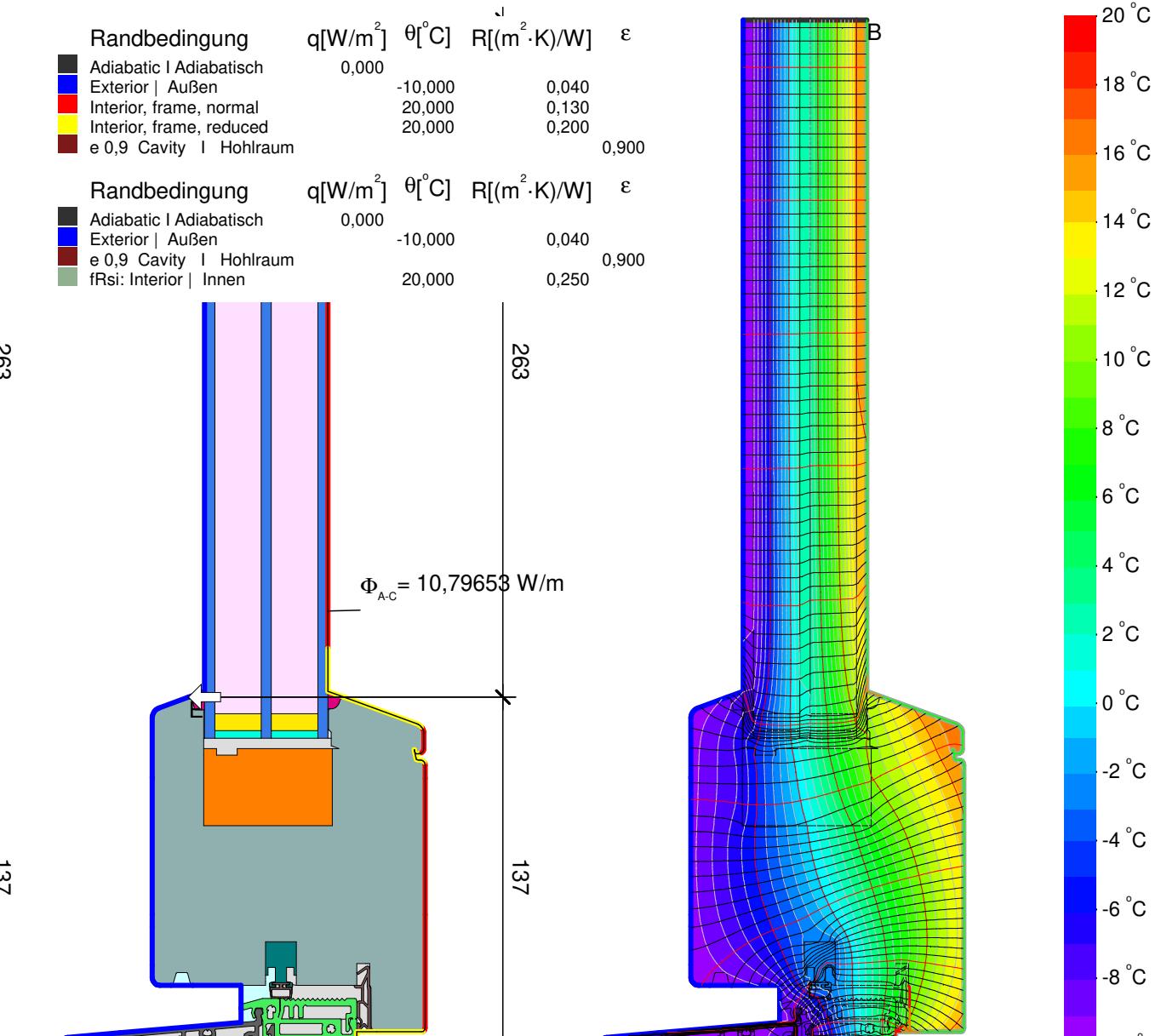
	$q[W/m^2]$	$\theta[^\circ C]$	$R[(m^2 \cdot K)/W]$	$\epsilon$
	0,000			
Exterior   Außen	-10,000		0,040	
e 0,9 Cavity   Hohlraum	20,000		0,250	0,900
fRsi: Interior   Innen				

	Wescon Cedar Products Ltd.		th Threshold	to Top	s Side	sh Side door	bof Bottom fixed	tof Top fixed	sf Side fixed	fm Flying mullion	m1 Mullion	m1a Mullion	glass junction	
	<b>Wood Entry Door (Glazed)</b>		Schwelle	Oben	Seitl.	Seite Tür	Unten fest	Oben fest	Seitl. fest	Stulp	Pfosten	Pfosten	Glas-einsatz	
	Spacer   Abstandhalter: SuperSpacer Premium													
frame values   Rahmenwerte	Temperaturefactor Temperaturfaktor	$f_{Rsi=0,25m^2K/W}$	0,56	0,74	0,74	0,74	0,73	0,73	0,73	0,74	0,72			
	Frame width Rahmenbreite	$b_f$ [mm]	137	176	176	176	78	78	78	246	156			
	U-value frame Rahmen-U-Wert	$U_f$ [W/(m²K)]	1,14	0,78	0,78	0,80	0,80	0,80	0,80	0,88	0,83			
	Door leaf   glazing Türblatt   Glas	$U$ [W/(m²K)]		0,70			0,70			0,70				
		Thickness   Dicke		48 mm			48 mm			48 mm				
	$\Psi$ -door leaf   -glass edge Türblatt- $\Psi$ -Wert   Rahmen-	$\Psi_{dl}$ [W/(mK)]	0,020	0,020	0,020	0,020	0,020	0,020	0,020	0,020	0,020			
	U-value door Tür-U-Wert	$U_D$ [W/(m²K)]		0,80			0,78			Description   Beschreibung				
	Combination   Kombination			0,79						Holz-Rahmen mit Corkdämmung (0,040 W/(mK)). Verglasung: 4/18/4/18/4; Glaseinstand: 21 mm; Abstandhalter: Superspacer Premium; Sekundärabdichtung: Butyl. An Schwelle wird der Temperaturfaktor für das kühl-gemäßigte Klima nicht erreicht. Dennoch liegen die erzielten Kennwerte weit über den Marktüblichen. Über die Anforderung hinaus gehend wird Luftdichtheitsklasse 3 nach EN 12207 erreicht.				
Installation   Einbau	<b>EIFS   WDVS U-Wall = 0,133 W/(m²K)</b>													
	$\Psi_{install}$ [W/(mK)]	0,081*	0,000	0,000	0,000	0,038*	-0,005	-0,005						
	$U_{W, installed}$ [W/(m²K)]		0,84			0,79								
	$\Psi_{install}$ [W/(mK)]	0,066	to floor slab   zu Bodenplatte			0,009	* to unheated basement   zu unbeheiztem Keller							
	$\Psi_{install}$ [W/(mK)]	0,084	to heated storey   zu beh. Geschoss			0,025								
	<b>Lightweight timber construction   Holzleichtbau U-Wall = 0,132 W/(m²K)</b>													
	$\Psi_{install}$ [W/(mK)]	0,081*	0,005	0,007	0,006	0,038*	0,005	0,005						
	$U_{W, installed}$ [W/(m²K)]		0,85			0,81								
	<b>Formwork blocks   Betonschalungsstein U-Wall = 0,146 W/(m²K)</b>													Contact person   Ansprechpartner
	$\Psi_{install}$ [W/(mK)]	0,081*	0,001	0,001	0,000	0,038*	-0,004	-0,004						Wescon Cedar Products Ltd., Braden Gierc +1-250-748-5595, braden@fensturwindows.com
	$U_{W, installed}$ [W/(m²K)]		0,84			0,79								
	$\Psi_{install}$ [W/(mK)]													Calculation   Berechnung
	$U_{W, installed}$ [W/(m²K)]													Passivhaus Institut Darmstadt 23.08.2018



Material	$\lambda [W/(m \cdot K)]$	$\epsilon$
ABS (Acrylnitril-Butadien-Styrol)	0,200	0,900
Aluminum I Aluminium 10456	160,000	0,900
Ar18 in 48 mm U 0,7	0,029	
Butyl	0,240	0,900
EPDM	0,250	0,900
Glass I Glas	1,000	0,900
Silicone I Silikon	0,350	0,900
Spruce, Fir I Fichte, Tanne	0,110	0,900
Steel I Stahl	50,000	0,900
SuperSpacer Premium_Box2 [cert]	0,150	
Thermacork 040	0,040	0,900
Unvent. cavity I unbel. Hohlr. **		
slightly vent. cav. I leicht bel. Hohlr. **		
** EN ISO 10077-2:2017, 6.4.3		

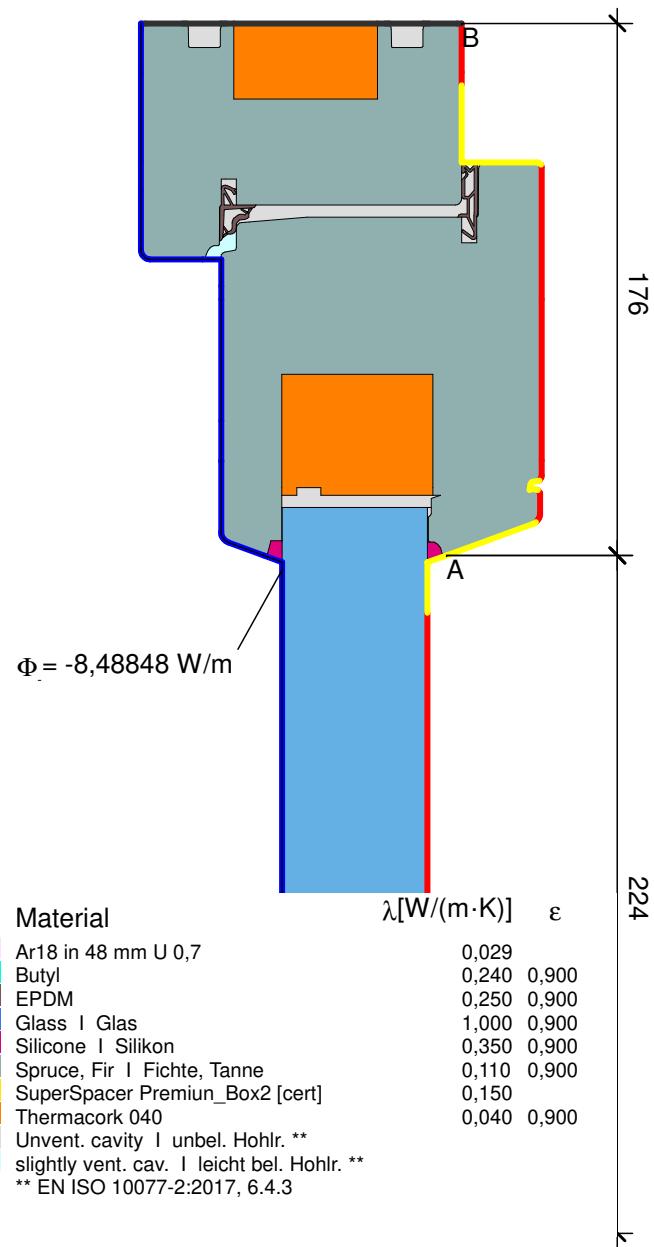
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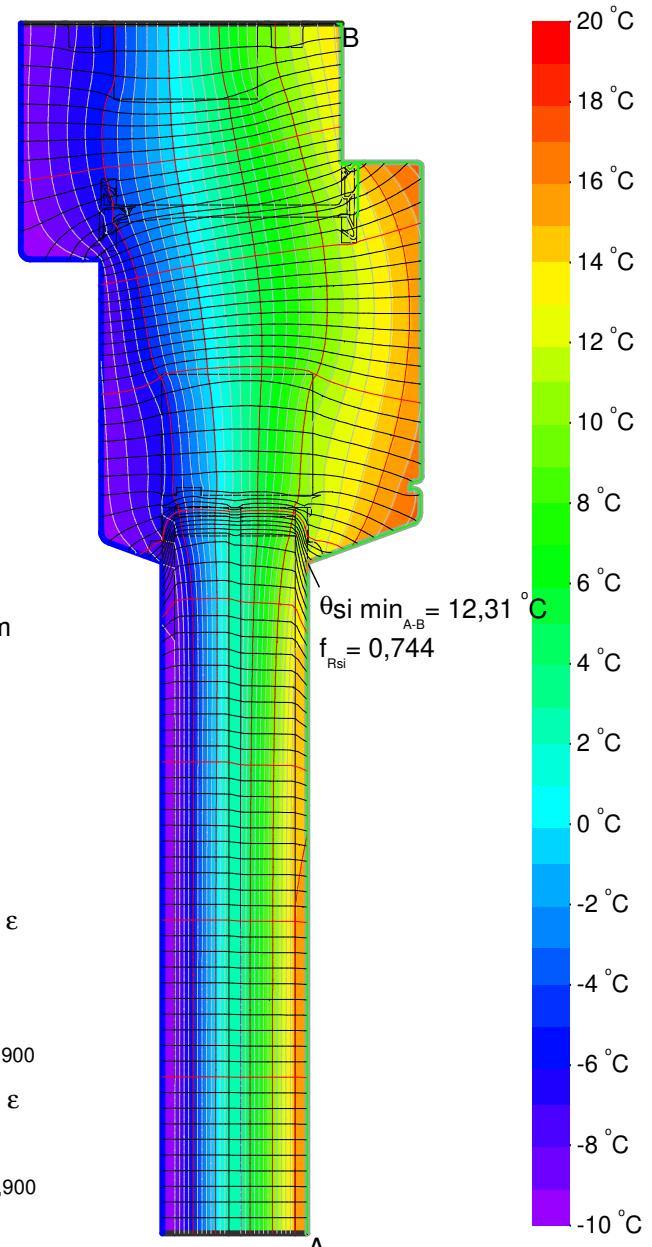
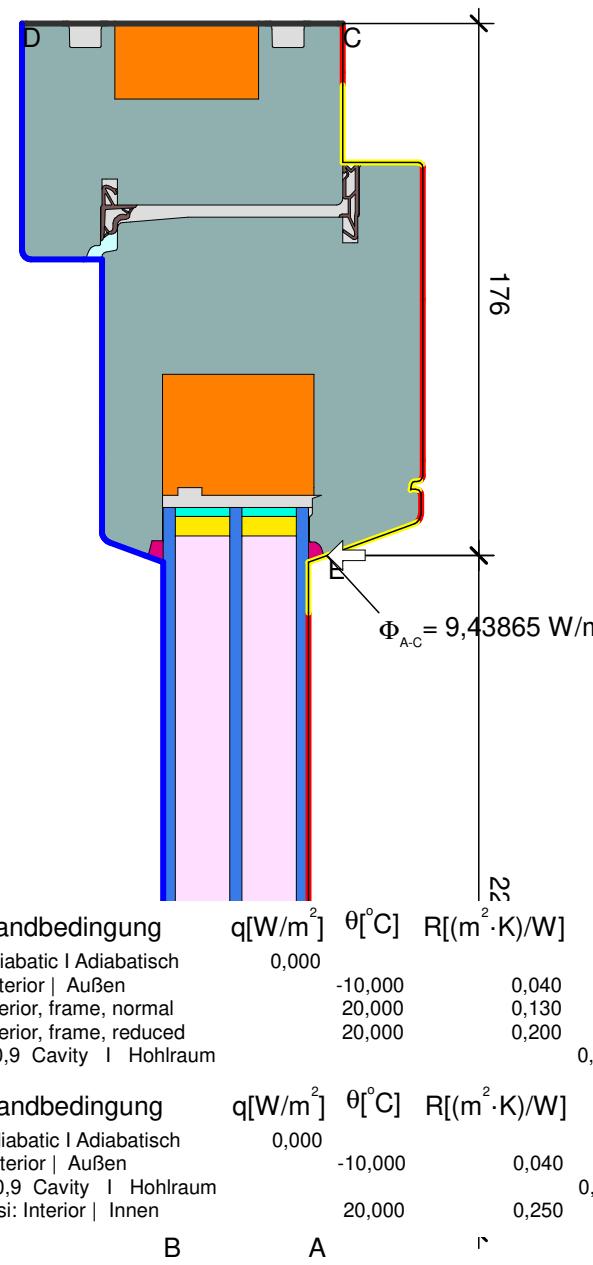
$$U_{f,A,B} = \frac{\frac{\Phi}{\Delta T} - U_p \cdot b_p}{b_f} = \frac{\frac{9,791}{30,000}}{0,137} - 0,649 \cdot 0,263 = 1,137 \text{ W}/(m^2 \cdot K) \quad \Psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{10,797}{30,000} - 1,137 \cdot 0,137 - 0,700 \cdot 0,263 = 0,564 \text{ W}/(m \cdot K)$$

th - THRESHOLD I SCHWELLE



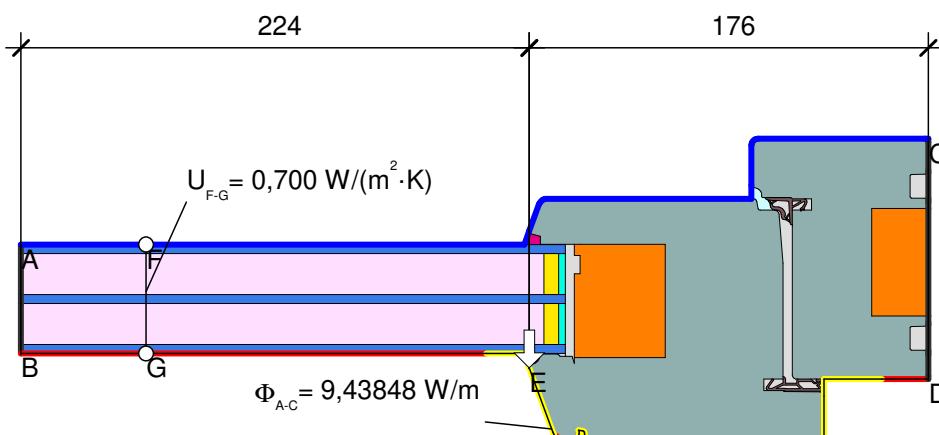
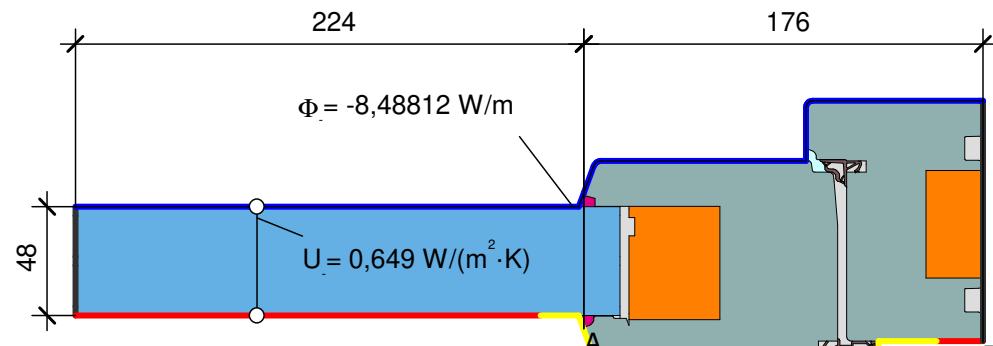


$$U_{fA,B} = \frac{\frac{\Phi}{\Delta T} - U_p \cdot b_p}{b_f} = \frac{\frac{8,488}{30,000} - 0,649 \cdot 0,224}{0,176} = 0,782 \text{ W}/(\text{m}^2 \cdot \text{K})$$

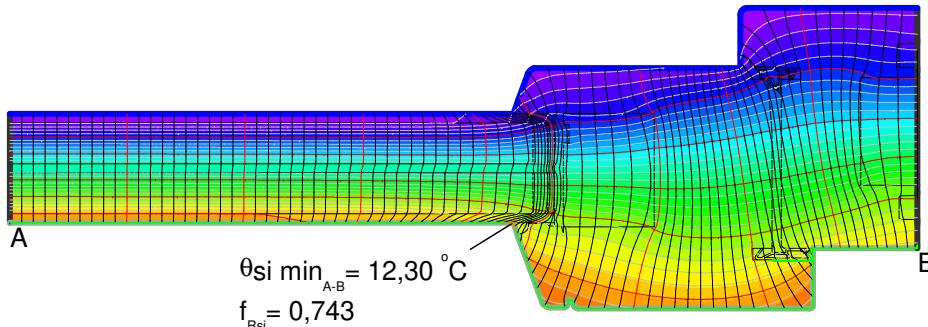


to - TOP | OBEN





$$\psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{9,438}{30,000} - 0,700 \cdot 0,224 - 0,782 \cdot 0,176 = 0,020 \text{ W}/(\text{m} \cdot \text{K})$$



si HINGE SIDE I BANDSEITE

### Material

Material	$\lambda [\text{W}/(\text{m} \cdot \text{K})]$	$\epsilon$
Ar18 in 48 mm U 0,7	0,029	
Butyl	0,240	0,900
EPDM	0,250	0,900
Glass   Glas	1,000	0,900
Silicone   Silikon	0,350	0,900
Spruce, Fir   Fichte, Tanne	0,110	0,900
SuperSpacer Premium_Box2 [cert]	0,150	
Thermacork 040	0,040	0,900
Univent. cavity   unbel. Hohlr. **		
slightly vent. cav.   leicht bel. Hohlr. **		
** EN ISO 10077-2:2017, 6.4.3		

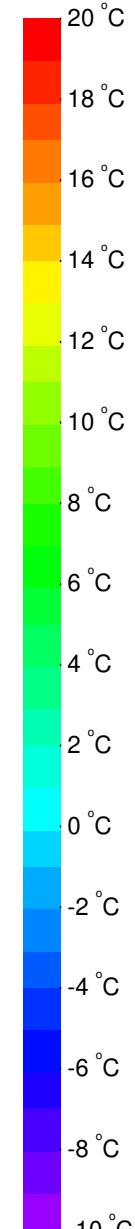
$$U_{f,A,B} = \frac{\Phi}{\Delta T} - U_p \cdot b_p = \frac{8,488}{30,000} - 0,649 \cdot 0,224 = 0,782 \text{ W}/(\text{m}^2 \cdot \text{K})$$

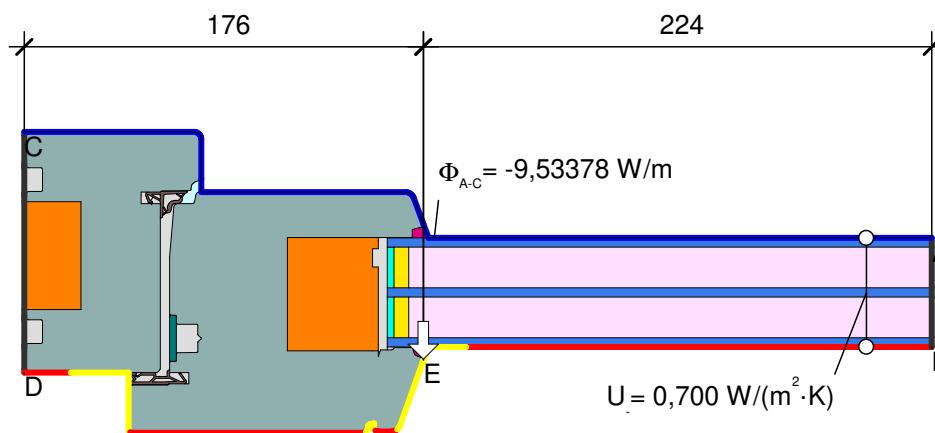
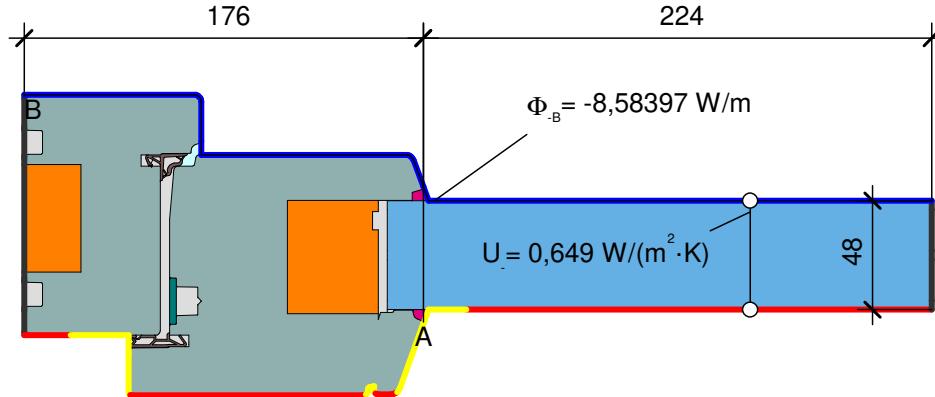
### Randbedingung

Randbedingung	$q [\text{W}/\text{m}^2]$	$\theta [{}^\circ\text{C}]$	$R [(\text{m}^2 \cdot \text{K})/\text{W}]$	$\epsilon$
Adiabatic   Adiabatisch	0,000			
Exterior   Außen	-10,000		0,040	
Interior, frame, normal	20,000		0,130	
Interior, frame, reduced	20,000		0,200	
e 0,9 Cavity   Hohlräum				0,900

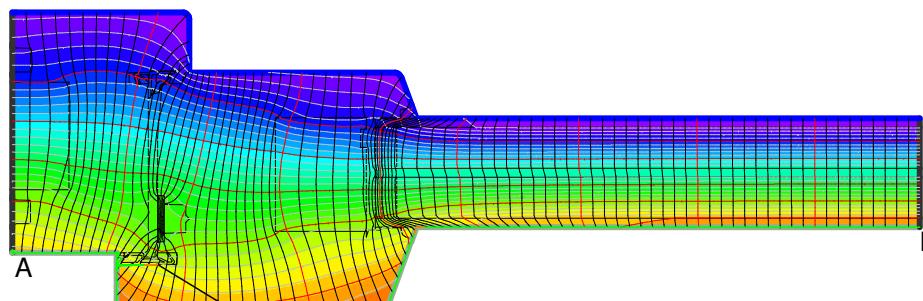
### Randbedingung

Randbedingung	$q [\text{W}/\text{m}^2]$	$\theta [{}^\circ\text{C}]$	$R [(\text{m}^2 \cdot \text{K})/\text{W}]$	$\epsilon$
Adiabatic   Adiabatisch	0,000			
Adiabatic   Adiabat	0,000			
Exterior   Außen	-10,000		0,040	
e 0,9 Cavity   Hohlräum	20,000		0,250	0,900
f_Rsi: Interior   Innen				





$$\psi_{A-E-C} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{9,534}{30,000} - 0,700 \cdot 0,224 - 0,800 \cdot 0,176 = 0,020 \text{ W/(m}\cdot\text{K)}$$



sh - LOCK SIDE | SCHLOSS SEITE

### Material

	$\lambda[\text{W}/(\text{m}\cdot\text{K})]$	$\epsilon$
Ar18 in 48 mm U 0,7	0,029	
Butyl	0,240	0,900
EPDM	0,250	0,900
Glass   Glas	1,000	0,900
Silicone   Silikon	0,350	0,900
Spruce, Fir   Fichte, Tanne	0,110	0,900
Steel   Stahl	50,000	0,900
SuperSpacer Premium_Box2 [cert]	0,150	
Thermacork 040	0,040	0,900
Unvent. cavity   unbel. Hohlr. **		
slightly vent. cav.   leicht bel. Hohlr. **		
** EN ISO 10077-2:2017, 6.4.3		

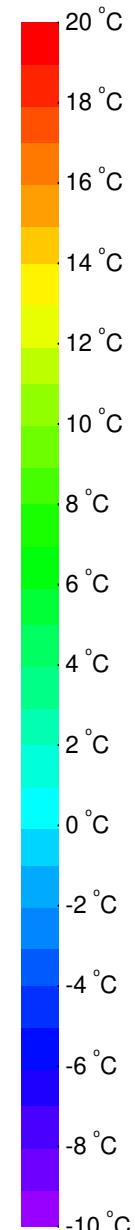
$$U_{f,A,B} = \frac{\frac{\Phi}{\Delta T} - U_p \cdot b_p}{b_f} = \frac{\frac{8,584}{30,000} - 0,649 \cdot 0,224}{0,176} = 0,800 \text{ W/(m}^2\cdot\text{K)}$$

### Randbedingung

	$q[\text{W}/\text{m}^2]$	$\theta[\text{ }^\circ\text{C}]$	$R[(\text{m}^2\cdot\text{K})/\text{W}]$	$\epsilon$
Adiabatic   Adiabatisch	0,000			
Exterior   Außen		-10,000	0,040	
Interior, frame, normal		20,000	0,130	
Interior, frame, reduced		20,000	0,200	
e 0,9 Cavity   Hohlräum				0,900

### Randbedingung

	$q[\text{W}/\text{m}^2]$	$\theta[\text{ }^\circ\text{C}]$	$R[(\text{m}^2\cdot\text{K})/\text{W}]$	$\epsilon$
Adiabatic   Adiabatisch	0,000			
Exterior   Außen		-10,000	0,040	
e 0,9 Cavity   Hohlräum		20,000	0,250	0,900
f <sub>Rs</sub> : Interior   Innen				



Material	$\lambda[W/(m \cdot K)]$	$\epsilon$
Ar18 in 48 mm U 0,7	0,029	
Butyl	0,240	0,900
Glass   Glas	1,000	0,900
Silicone   Silikon	0,350	0,900
Spruce, Fir   Fichte, Tanne	0,110	0,900
SuperSpacer Premium_Box2 [cert]	0,150	
Thermacork 040	0,040	
Univent. cavity   unbel. Hohlr. **		
slightly vent. cav.   leicht bel. Hohlr. **		
** EN ISO 10077-2:2017, 6.4.3		

$\lambda[W/(m \cdot K)]$      $\epsilon$

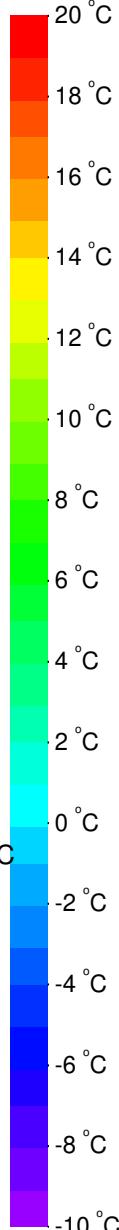
0,029	
0,240	0,900
1,000	0,900
0,350	0,900
0,110	0,900
0,150	
0,040	

Randbedingung

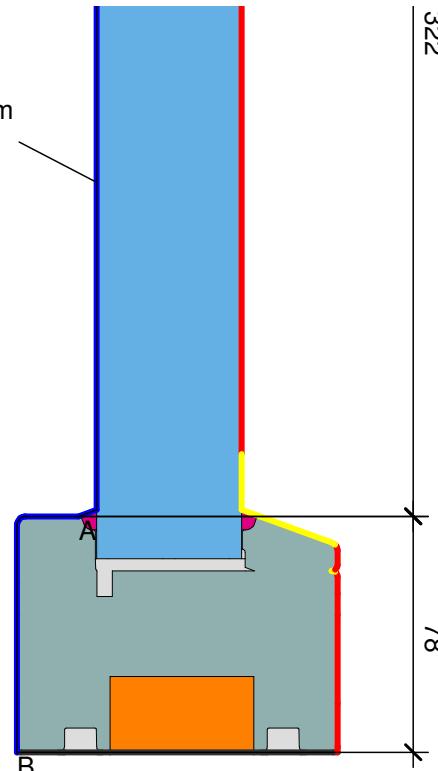
- Adiabatic | Adiabatisch
- Exterior | Außen
- e 0,9 Cavity | Hohlraum
- fRsi: Interior | Innen

$q[W/m^2]$      $\theta[^\circ C]$      $R[(m^2 \cdot K)/W]$      $\epsilon$

0,000	-10,000	0,040	0,900
	20,000	0,250	

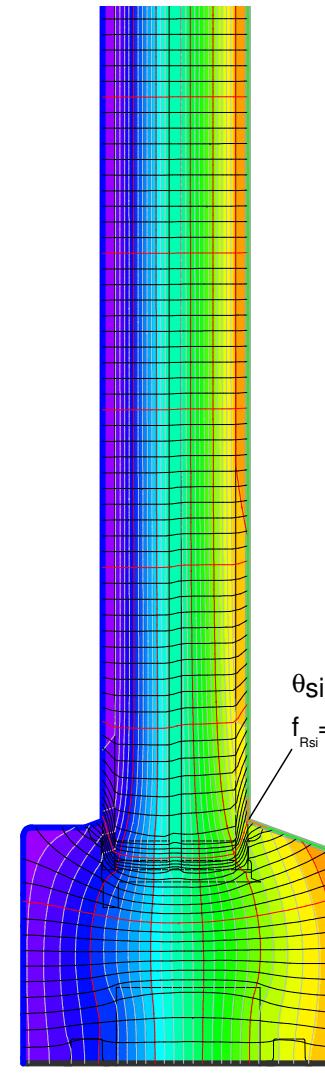
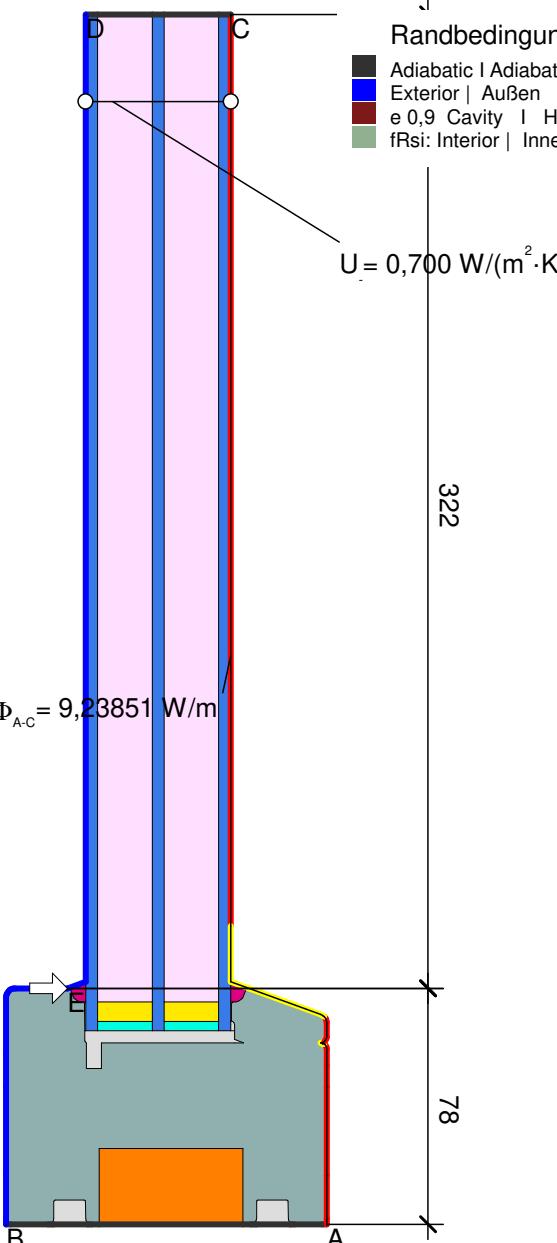


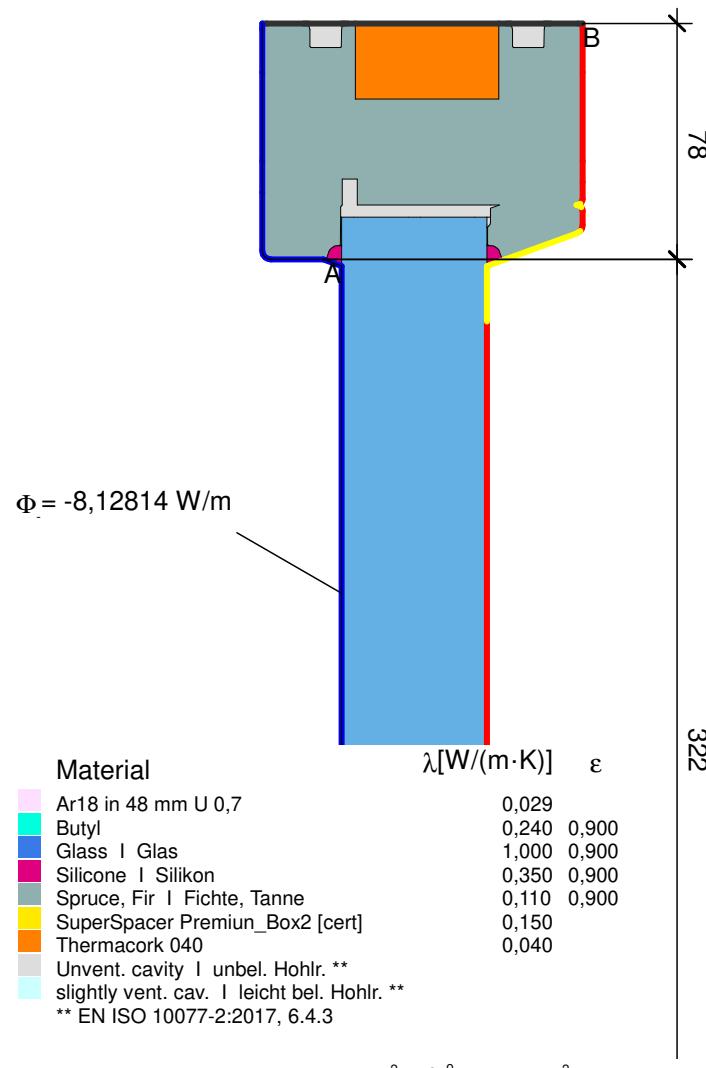
$$\Phi_B = -8,12847 \text{ W/m}$$



$$U_{f,A,B} = \frac{\frac{\Phi}{\Delta T} - U_p \cdot b_p}{b_f} = \frac{\frac{8,128}{30,000} - 0,649 \cdot 0,322}{0,078} = 0,796 \text{ W/(m}^2 \cdot \text{K})$$

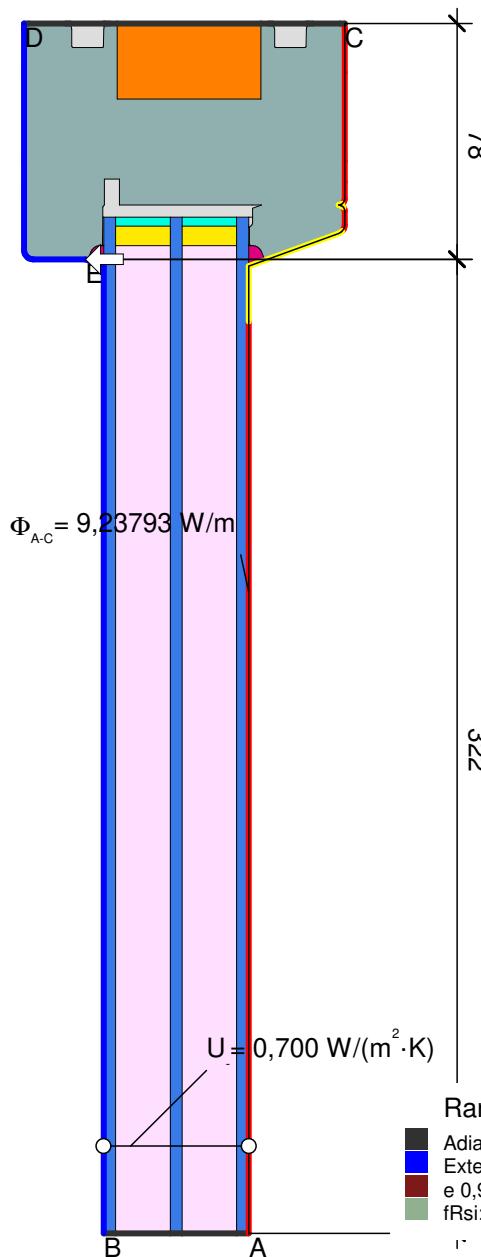
$$\Psi_{A-E-C,-} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{9,239}{30,000} - 0,796 \cdot 0,078 - 0,700 \cdot 0,322 = 0,020 \text{ W/(m} \cdot \text{K})$$



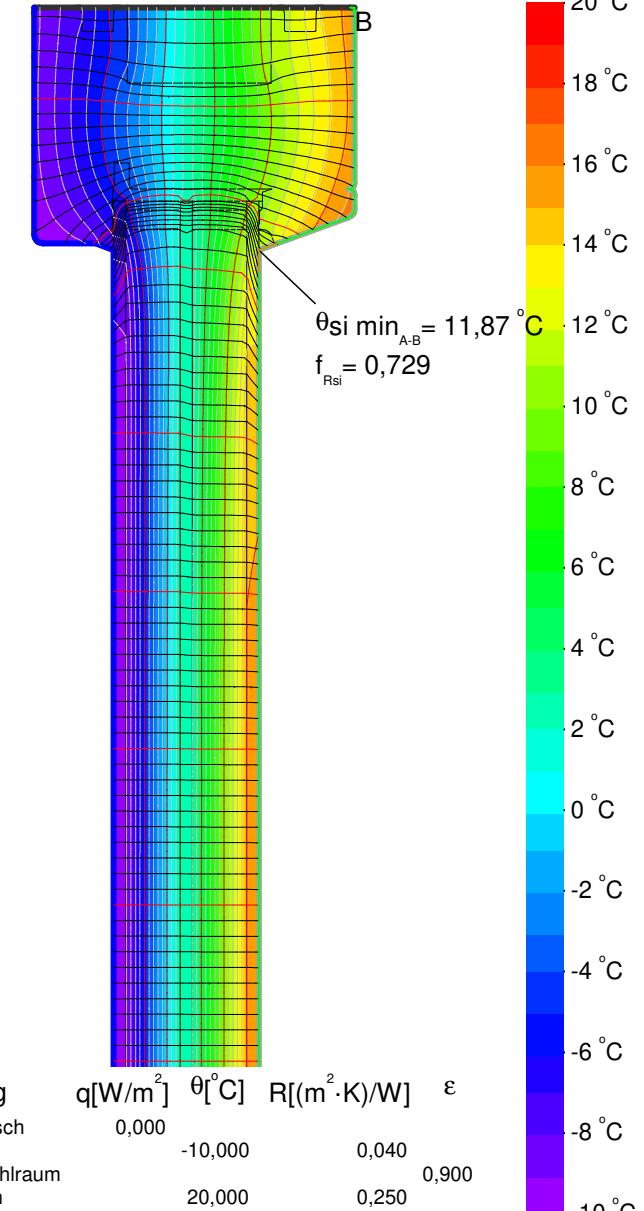


Randbedingung	$q [\text{W}/\text{m}^2]$	$\theta [{}^\circ\text{C}]$	$R [(\text{m}^2 \cdot \text{K})/\text{W}]$	$\epsilon$
Adiabatic I Adiabatisch	0,000			
Exterior   Außen	-10,000	0,040		
Interior, frame, normal	20,000	0,130		
Interior, frame, reduced	20,000	0,200		0,900
e 0,9 Cavity I Hohlraum				

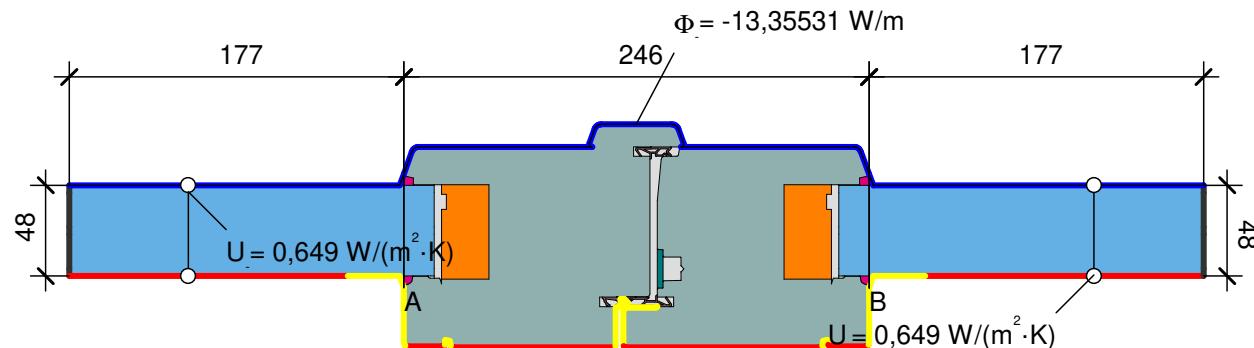
$$U_{f_{A,B}} = \frac{\Phi}{\Delta T} - U_p \cdot b_p = \frac{8,128}{30,000} - 0,649 \cdot 0,322 = 0,795 \text{ W}/(\text{m}^2 \cdot \text{K})$$



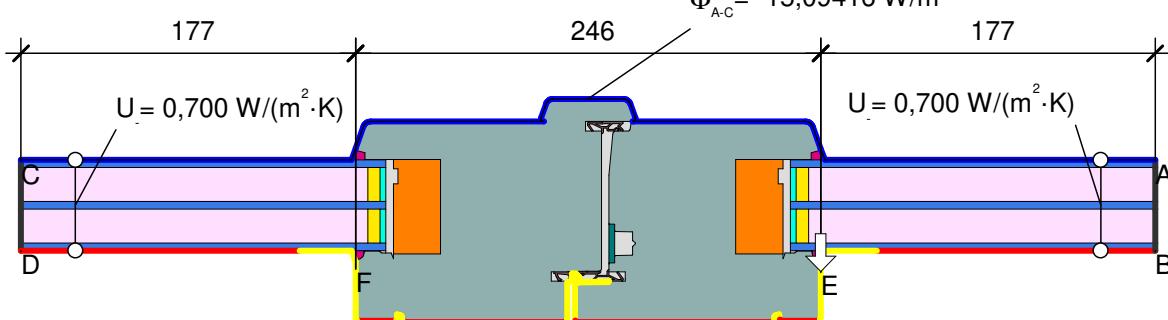
$$\psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 = \frac{9,238}{30,000} - 0,700 \cdot 0,322 - 0,795 \cdot 0,078 = 0,020 \text{ W}/(\text{m} \cdot \text{K})$$



tof - TOP FIXED | OBEN FEST VERGLAST

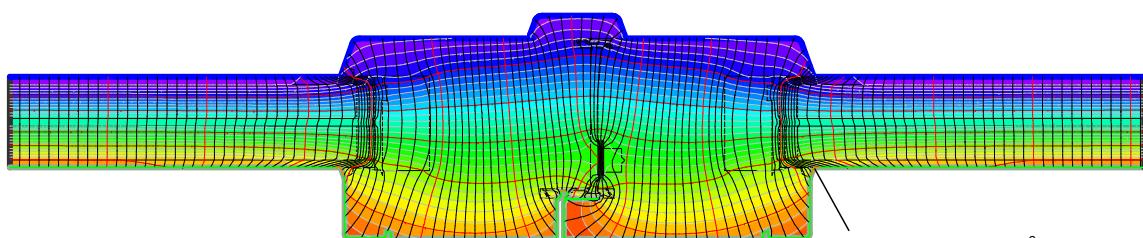


$$U_{TJA,B} = \frac{\Phi}{\Delta T} = \frac{13,355}{30,000} = \frac{0,246}{0,649 \cdot 0,177} = 0,876 \text{ W/(m}^2\cdot\text{K)}$$



$$\psi_{A-E-C,*} = \frac{\Phi}{\Delta T} = \frac{15,094}{30,000} = \frac{0,246 \cdot 0,700}{0,876 \cdot 0,177} = 0,040 \text{ W/(m}\cdot\text{K)}$$

$$PSIe = PSIa-b-c/2 = 0,040 \text{ W/(mK)}/2 = 0,020 \text{ W/(mK)}$$



### Material

Material	$\lambda[\text{W}/(\text{m}\cdot\text{K})]$	$\epsilon$
Ar18 in 48 mm U 0,7	0,029	
Butyl	0,240	0,900
EPDM	0,250	0,900
Glass   Glas	1,000	0,900
Silicone   Silikon	0,350	0,900
Spruce, Fir   Fichte, Tanne	0,110	0,900
Steel   Stahl	50,000	0,900
SuperSpacer Premium_Box2 [cert]	0,150	
Thermacork 040	0,040	0,900
Unvent. cavity   unbel. Hohlr. **		

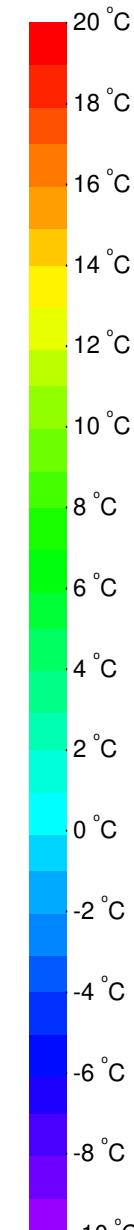
\*\* EN ISO 10077-2:2017, 6.4.3

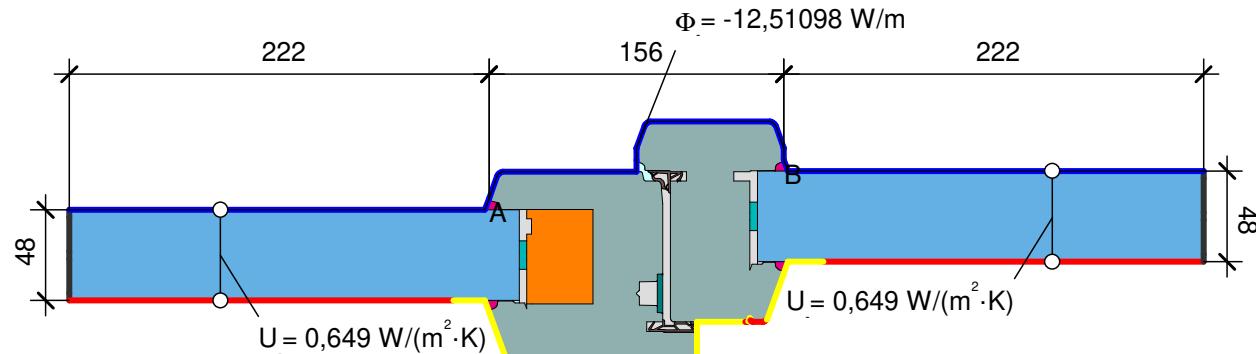
### Randbedingung

Randbedingung	$q[\text{W}/\text{m}^2]$	$\theta[\text{ }^\circ\text{C}]$	$R[(\text{m}^2\cdot\text{K})/\text{W}]$	$\epsilon$
Adiabatic   Adiabat	0,000			
Exterior   Außen	-10,000		0,040	
Interior, frame, normal	20,000		0,130	
Interior, frame, reduced	20,000		0,200	
e 0,9 Cavity   Hohlraum				0,900

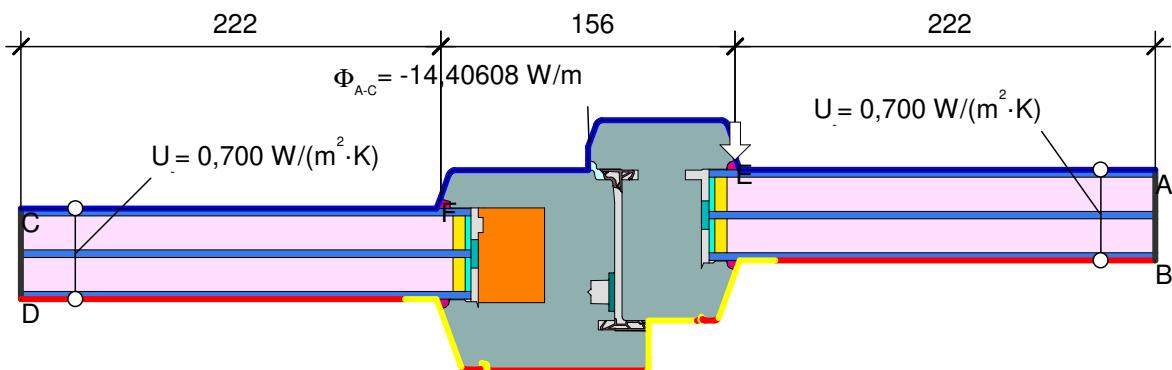
### Randbedingung

Randbedingung	$q[\text{W}/\text{m}^2]$	$\theta[\text{ }^\circ\text{C}]$	$R[(\text{m}^2\cdot\text{K})/\text{W}]$	$\epsilon$
Adiabatic   Adiabat	0,000			
Exterior   Außen	-10,000		0,040	
e 0,9 Cavity   Hohlraum	20,000		0,250	0,900
f_Rsi: Interior   Innen				



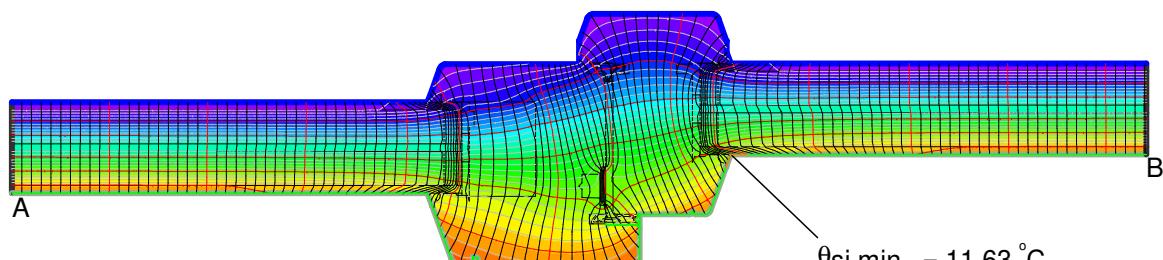


$$U_{f,A,B} = \frac{\Phi}{\Delta T} - \frac{U_{p1} \cdot b_{p1} - U_{p2} \cdot b_{p2}}{b_f} = \frac{12,511}{30,000} - \frac{0,649 \cdot 0,222 - 0,649 \cdot 0,222}{0,156} = 0,827 \text{ W}/(\text{m}^2 \cdot \text{K})$$



$$\psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - U_2 \cdot b_2 - U_3 \cdot b_3 = \frac{14,406}{30,000} - 0,700 \cdot 0,222 - 0,827 \cdot 0,156 - 0,700 \cdot 0,222 = 0,040 \text{ W}/(\text{m} \cdot \text{K})$$

$$PSle = PSla-b-c/2 = 0,040 \text{ W}/(\text{mK})/2 = 0,020 \text{ W}/(\text{mK})$$

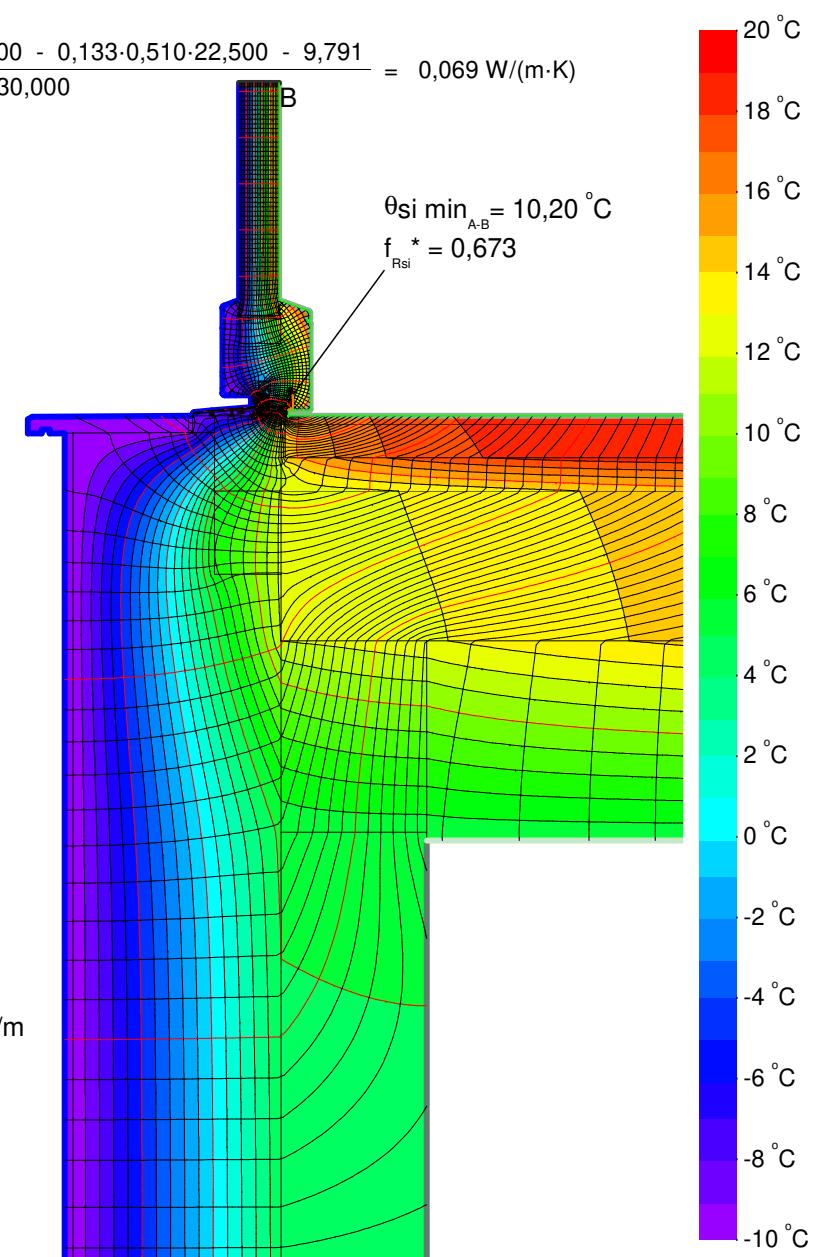
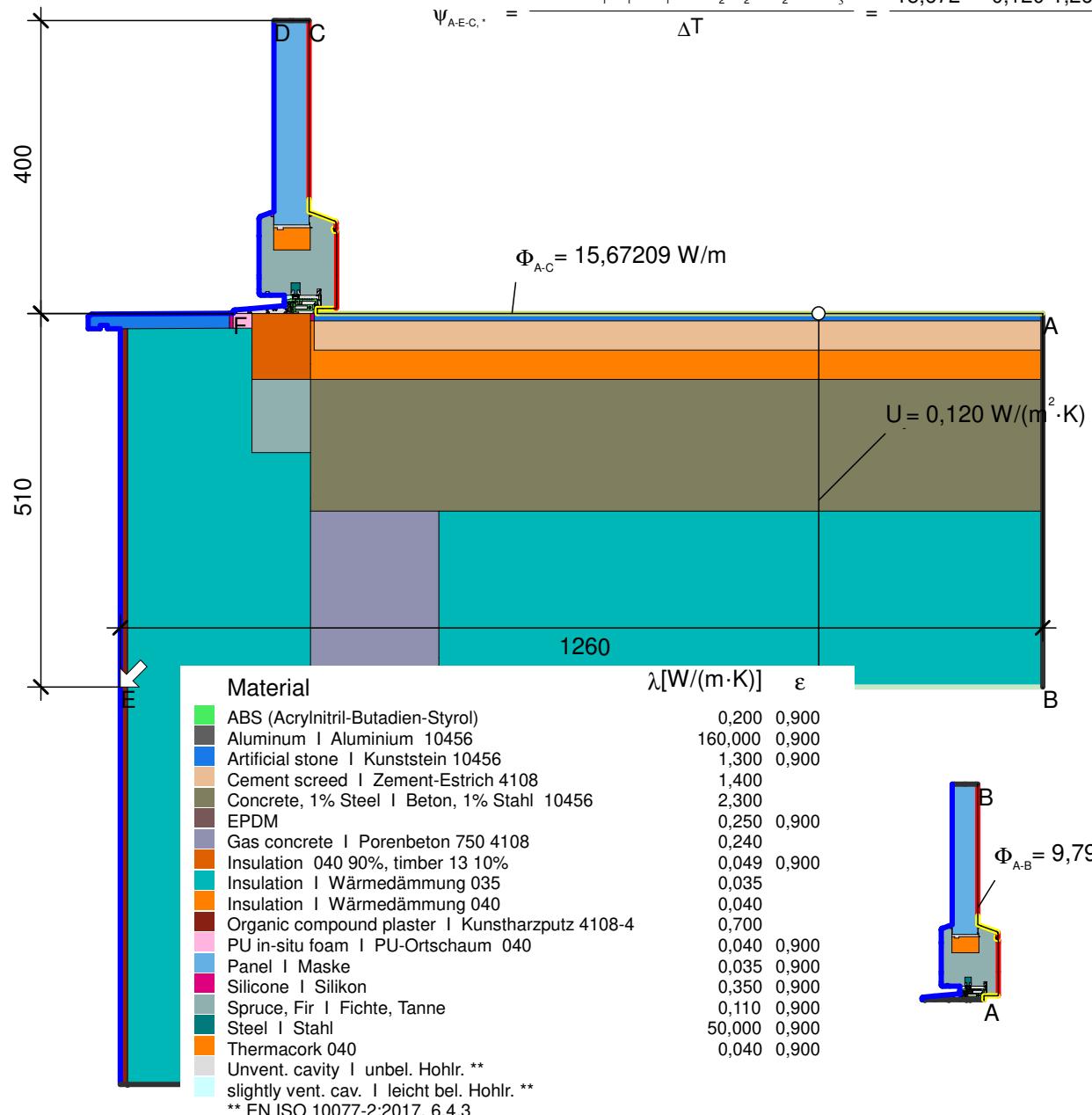


Material	$\lambda[\text{W}/(\text{m} \cdot \text{K})]$	$\varepsilon$	20 °C
Ar18 in 48 mm U 0,7	0,029		18 °C
Butyl	0,240	0,900	16 °C
EPDM	0,250	0,900	14 °C
Glass I Glas	1,000	0,900	12 °C
Insulation I Wärmedämmung 035	0,035	0,900	10 °C
Silicone I Silikon	0,350	0,900	8 °C
Spruce, Fir I Fichte, Tanne	0,110	0,900	6 °C
Steel I Stahl	50,000	0,900	4 °C
SuperSpacer Premium_Box2 [cert]	0,150		2 °C
Thermacork 040	0,040	0,900	-2 °C
Unvent. cavity I unbel. Hohlr. **			-4 °C
slightly vent. cav. I leicht bel. Hohlr. **			-6 °C
** EN ISO 10077-2:2017, 6.4.3			-8 °C
			-10 °C

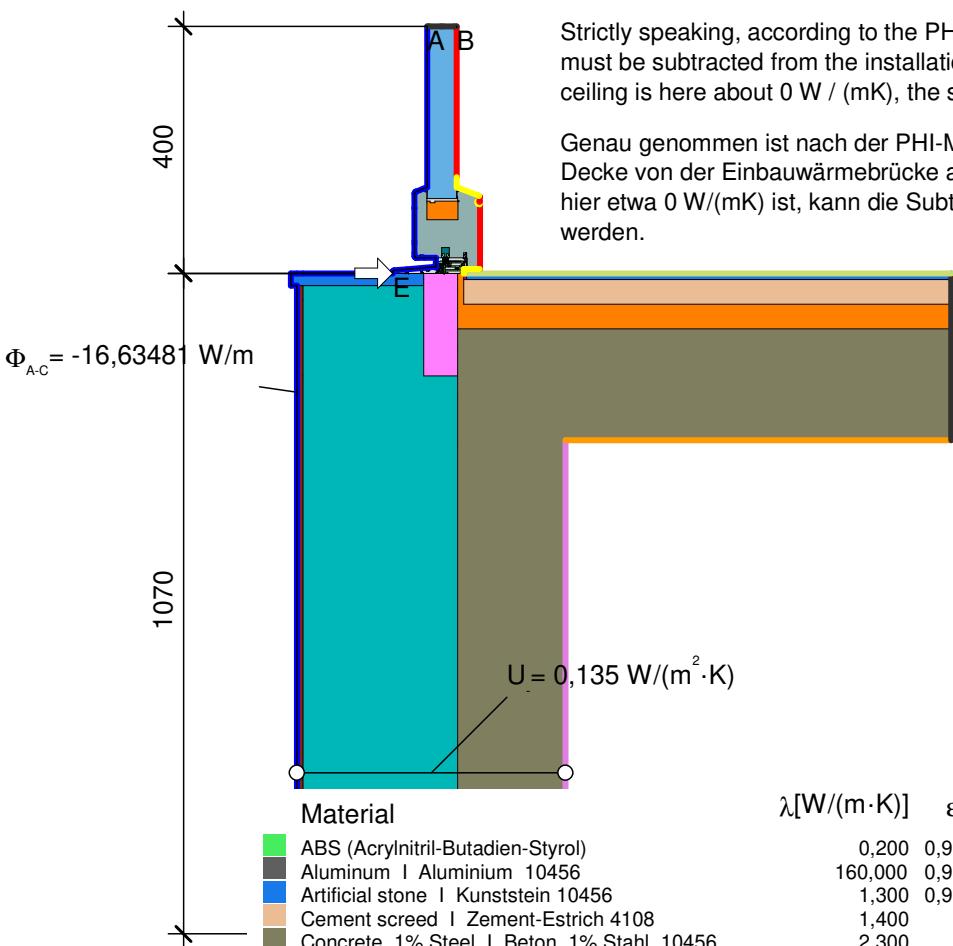
Randbedingung	$q[\text{W}/\text{m}^2]$	$\theta[{}^\circ\text{C}]$	$R[(\text{m}^2 \cdot \text{K})/\text{W}]$	$\varepsilon$	20 °C
Adiabatic I Adiabatisch	0,000				
Adiabatic   Adiabat	0,000				
Exterior   Außen					
Interior, frame, normal	-10,000	20,000	0,040	0,130	18 °C
Interior, frame, reduced	20,000	20,000	0,200	0,200	16 °C
e 0,9 Cavity I Hohlraum				0,900	14 °C
Randbedingung	$q[\text{W}/\text{m}^2]$	$\theta[{}^\circ\text{C}]$	$R[(\text{m}^2 \cdot \text{K})/\text{W}]$	$\varepsilon$	12 °C
Adiabatic   Adiabat	0,000				
Exterior   Außen	-10,000	20,000	0,040	0,250	10 °C
e 0,9 Cavity I Hohlraum	20,000	20,000	0,250	0,900	8 °C
fRsi: Interior   Innen					6 °C

$$\Psi_{WIBO} = \Psi_{BCEW+WIBO} - \Psi_{BCEW} = 0,069 - -0,012 \text{ W/(mK)} = 0,081 \text{ W/(mK)}$$

$$\Psi_{A-E-C,*} = \frac{\Phi - U_1 \cdot b_1 \cdot \Delta T_1 - U_2 \cdot b_2 \cdot \Delta T_2 - \Phi_3}{\Delta T} = \frac{15,672 - 0,120 \cdot 1,260 \cdot 15,000 - 0,133 \cdot 0,510 \cdot 22,500 - 9,791}{30,000} = 0,069 \text{ W/(m}\cdot\text{K)}$$

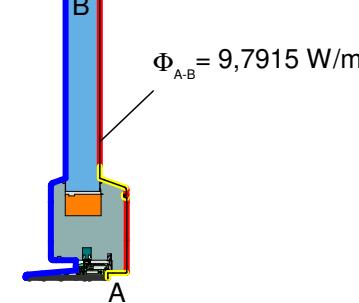


$$\Psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_1}{\Delta T} - U_2 \cdot b_2 = \frac{16,635}{30,000} - \frac{9,791}{30,000} - 0,135 \cdot 1,070 = 0,084 \text{ W/(m}\cdot\text{K)}$$



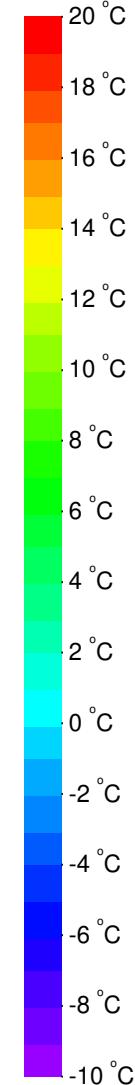
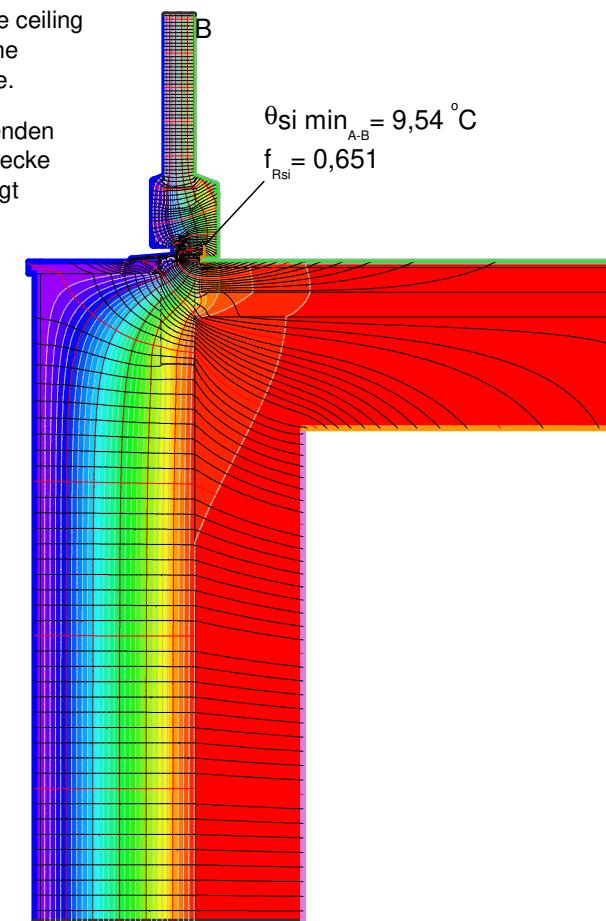
Strictly speaking, according to the PHI methodology, the thermal bridge of the ceiling must be subtracted from the installation bridge. Since the thermal bridge of the ceiling is here about 0 W / (mK), the subtraction can be neglected in this case.

Genau genommen ist nach der PHI-Methodik die Wärmebrücke der einbindenden Decke von der Einbauwärmebrücke abzuziehen. Da die Wärmebrücke der Decke hier etwa 0 W/(mK) ist, kann die Subtraktion hier vereinfachend vernachlässigt werden.

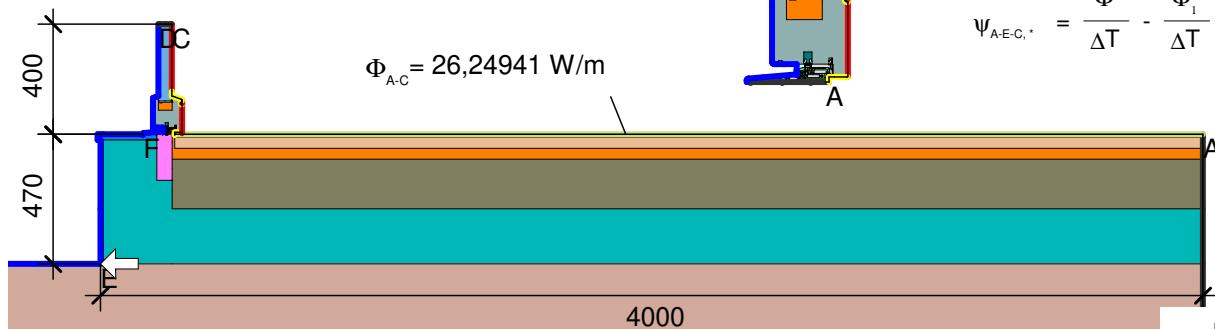
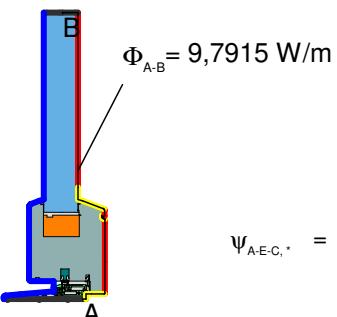
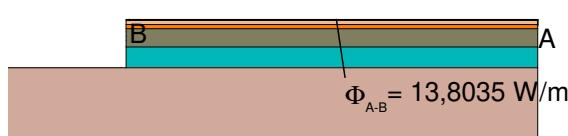


$\lambda[\text{W}/(\text{m}\cdot\text{K})]$	$\varepsilon$
0,200	0,900
160,000	0,900
1,300	0,900
1,400	
2,300	
0,250	0,900
0,035	
0,040	0,900
0,700	
0,035	0,900
0,086	0,900
0,350	0,900
0,110	0,900
50,000	0,900
0,040	0,900

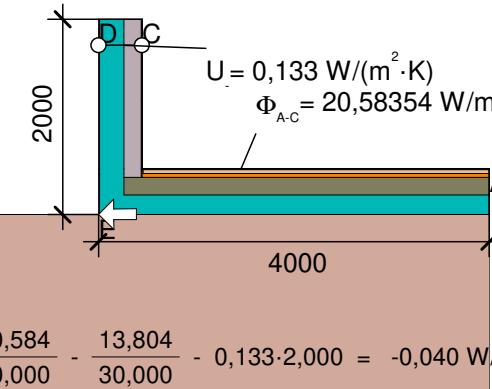
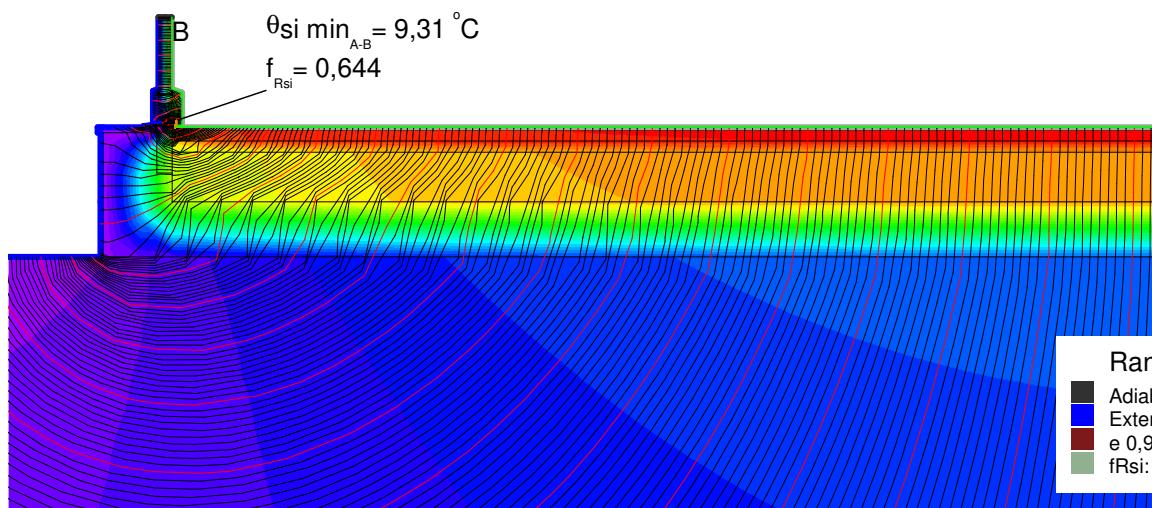
Randbedingung	$q[\text{W}/\text{m}^2]$	$\theta[^{\circ}\text{C}]$	$R[(\text{m}^2 \cdot \text{K})/\text{W}]$	$\varepsilon$
Adiabatic   Adiabatisch	0,000			
Adiabatic   Adiabat	0,000			
Exterior   Außen	-10,000		0,040	
Int. flux down   Innen abwärts	20,000		0,170	
Interior up.   Innen auf.	20,000		0,100	
Interior   Innen	20,000		0,130	
Interior, frame, normal	20,000		0,130	
Interior, frame, reduced	20,000		0,200	
e 0,9 Cavity   Hohlräum			0,900	



$$\Psi_{WITH} = \Psi_{FSEW+WITH} - \Psi_{FSEW} = 0,026 - -0,040 = 0,066 \text{ W/mK}$$



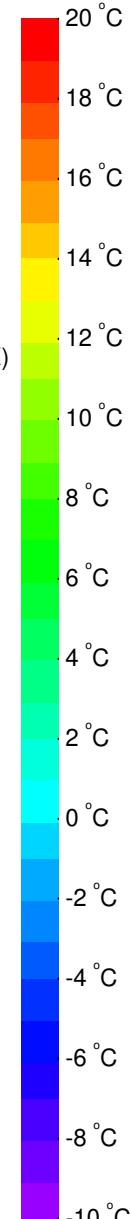
$$\Psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_1}{\Delta T} - U_2 \cdot b_2 - \frac{\Phi_3}{\Delta T} = \frac{26,249}{30,000} - \frac{13,804}{30,000} - 0,133 \cdot 0,470 - \frac{9,791}{30,000} = 0,026 \text{ W/(m·K)}$$



$$\Psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_1}{\Delta T} - U_2 \cdot b_2 = \frac{20,584}{30,000} - \frac{13,804}{30,000} - 0,133 \cdot 2,000 = -0,040 \text{ W/(m·K)}$$

#### Material

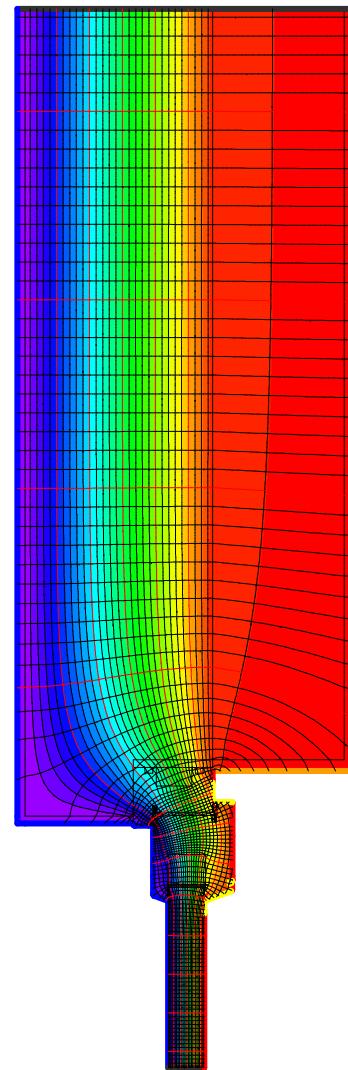
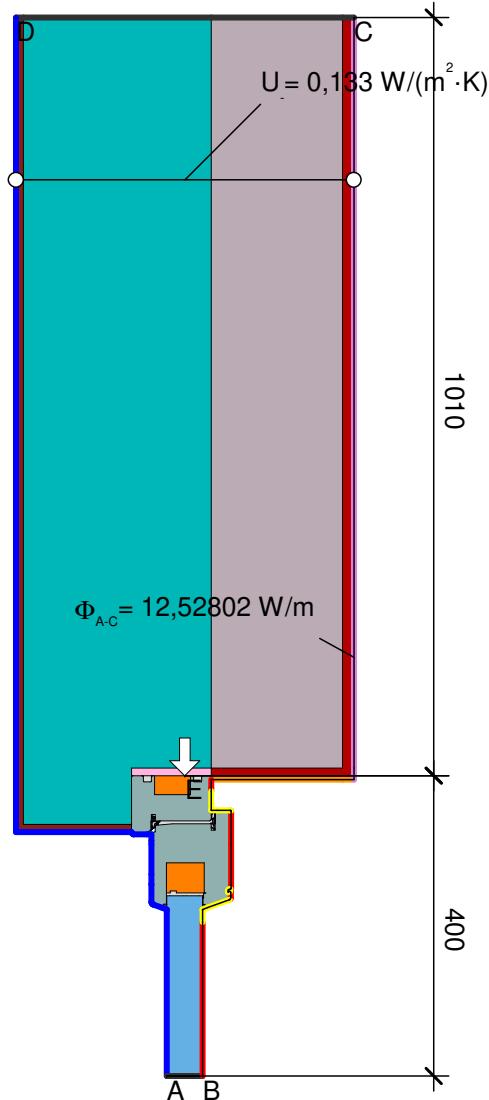
	$\lambda[\text{W}/(\text{m} \cdot \text{K})]$	$\epsilon$
ABS (Acrylnitril-Butadien-Styrol)	0,200	0,900
Aluminum   Aluminium 10456	160,000	0,900
Artificial stone   Kunststein 10456	1,300	0,900
Cement screed   Zement-Estrich 4108	1,400	
Concrete, 1% Steel   Beton, 1% Stahl 10456	2,300	
EPDM	0,250	0,900
Ground   Erdreich	2,000	
Insulation   Wärmedämmung 035	0,035	
Insulation   Wärmedämmung 040	0,040	0,900
Organic compound plaster   Kunstharzputz 4108-4	0,700	
Panel   Maske	0,035	0,900
Purenit 500 M	0,086	0,900
Silicone   Silikon	0,350	0,900
Spruce, Fir   Fichte, Tanne	0,110	0,900
Steel   Stahl	50,000	0,900
Thermacork 040	0,040	0,900
Unvent. cavity   unbel. Hohlr. **		
slightly vent. cav.   leicht bel. Hohlr. **		
** EN ISO 10077-2:2017, 6.4.3		



#### Randbedingung

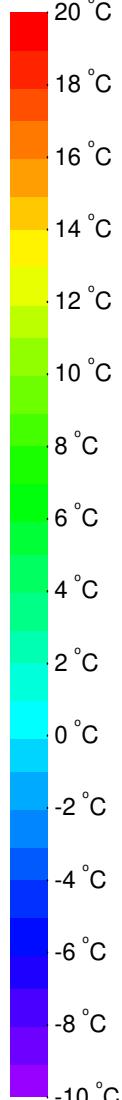
	$q[\text{W}/\text{m}^2]$	$\theta[\text{°C}]$	$R[(\text{m}^2 \cdot \text{K})/\text{W}]$	$\epsilon$
Adiabatic   Adiabatisch	0,000			
Exterior   Außen		-10,000	0,040	
$\epsilon 0,9$ Cavity   Hohlraum		20,000	0,250	0,900
fRsi: Interior   Innen				





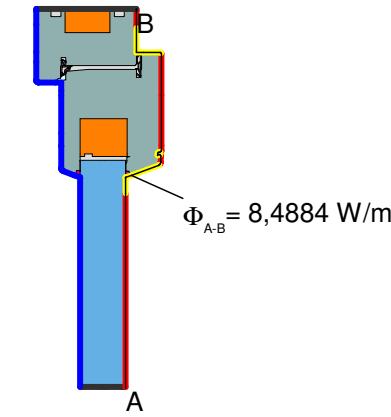
### Material

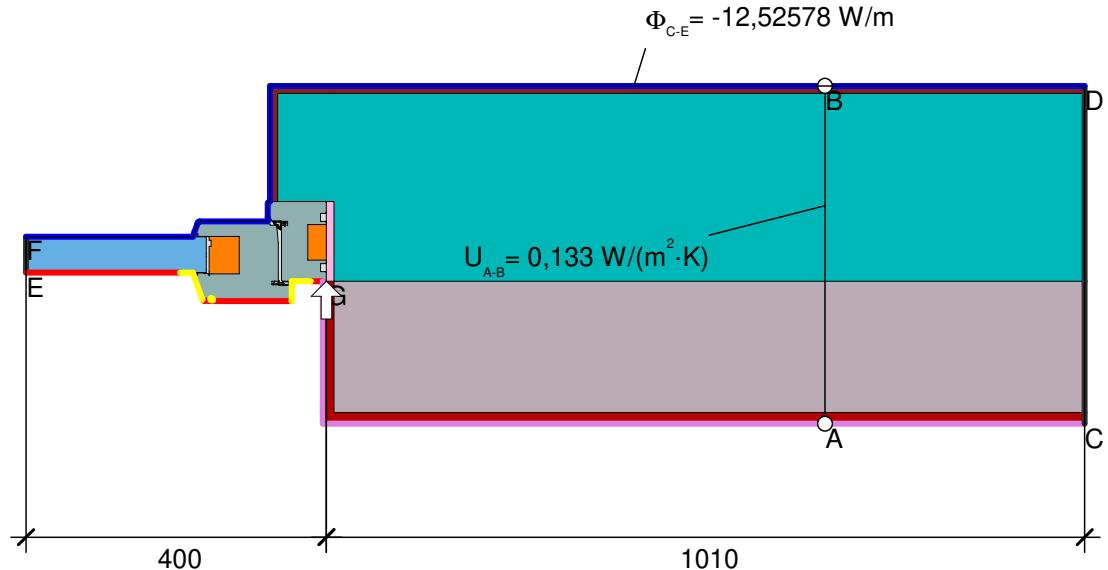
Material	$\lambda[\text{W}/(\text{m}\cdot\text{K})]$	$\varepsilon$
EPDM	0,250	0,900
Insulation I Wärmedämmung 035	0,035	0,900
Interior plaster I Gipsputz 10456	0,570	0,900
Organic compound plaster I Kunstharzputz 4108-4	0,700	
PU in-situ foam I PU-Ortschaum 040	0,040	0,900
Panel I Maske	0,035	0,900
Sand-lime stone I Kalksandstein 1745	1,000	
Silicone I Silikon	0,350	0,900
Spruce, Fir I Fichte, Tanne	0,110	0,900
Thermacork 040	0,040	0,900
Unvent. cavity I unbel. Hohlr. **		
slightly vent. cav. I leicht bel. Hohlr. **		
** EN ISO 10077-2:2017, 6.4.3		



Randbedingung	$q[\text{W}/\text{m}^2]$	$\theta[\text{°C}]$	$R[(\text{m}^2\cdot\text{K})/\text{W}]$	$\varepsilon$
Adiabatic I Adiabatisch	0,000			
Adiabatic   Adiabat	0,000			
Exterior   Außen	-10,000		0,040	
Interior up.   Innen auf.	20,000		0,100	
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

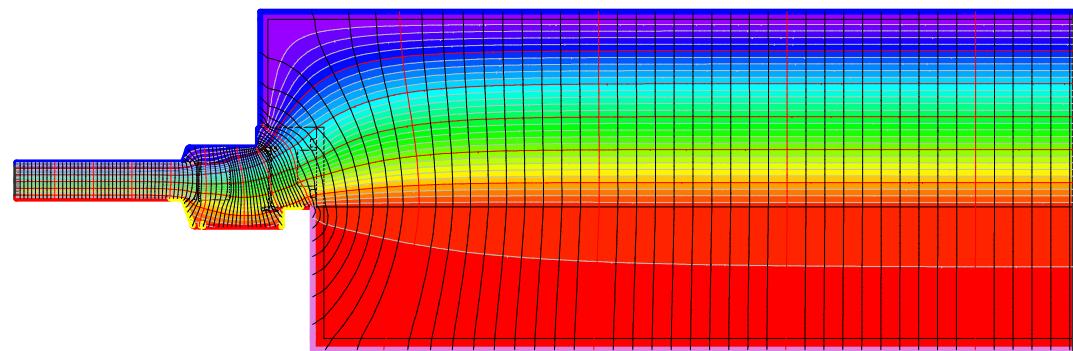
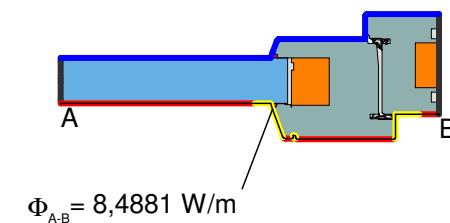
$$\Psi_{A-E,C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_1}{\Delta T} - U_2 \cdot b_2 = \frac{12,528}{30,000} - \frac{8,488}{30,000} - 0,133 \cdot 1,010 = 0,000 \text{ W/(m}\cdot\text{K)}$$



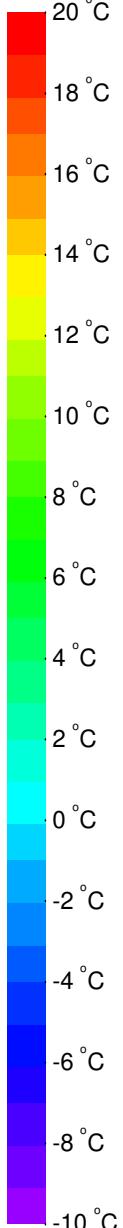


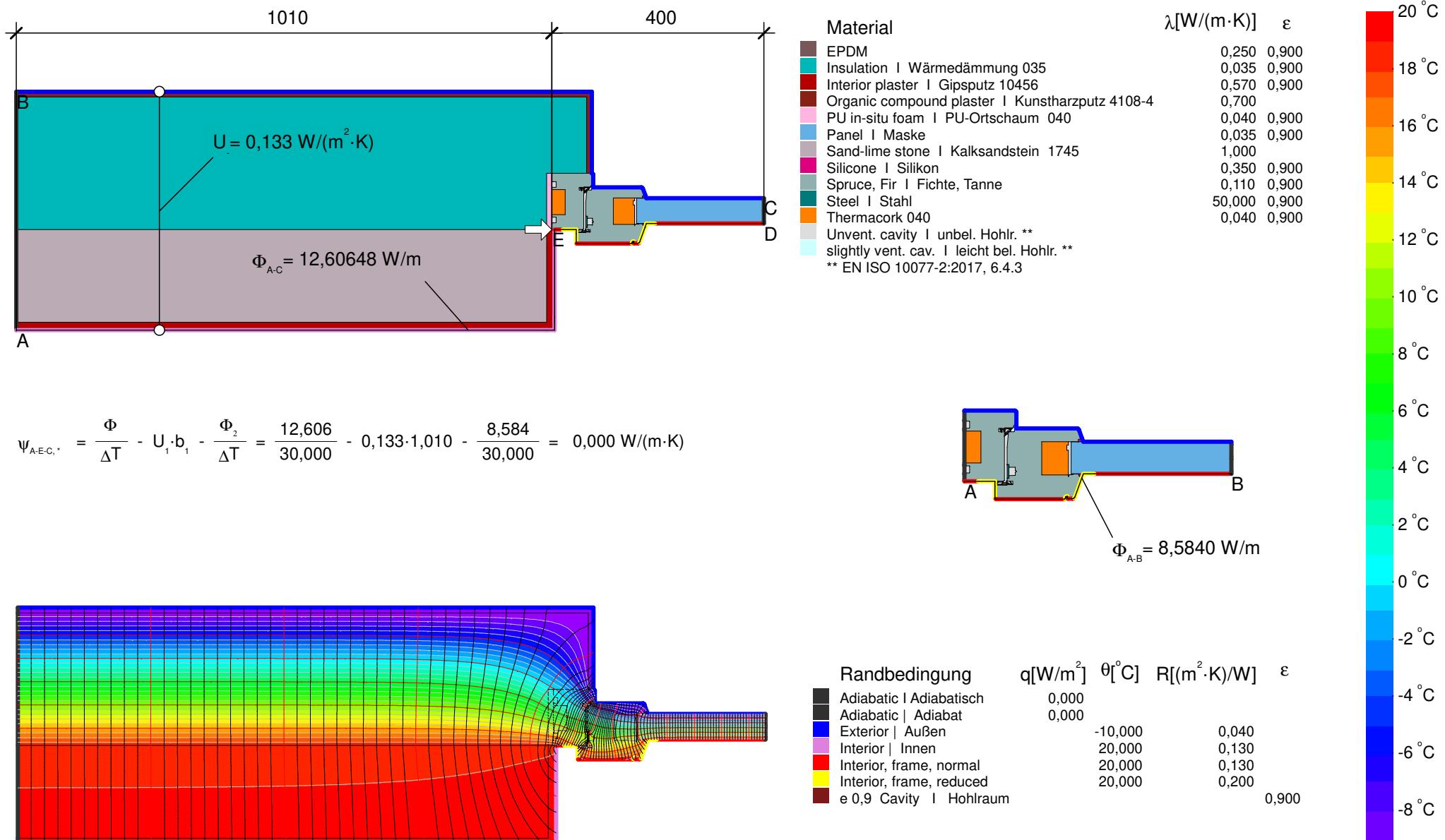
$$\Psi_{C-G-E,\cdot} = \frac{\Phi}{\Delta T} - U_i \cdot b_i - \frac{\Phi_2}{\Delta T} = \frac{12,526}{30,000} - 0,133 \cdot 1,010 - \frac{8,488}{30,000} = 0,000 \text{ W}/(\text{m} \cdot \text{K})$$

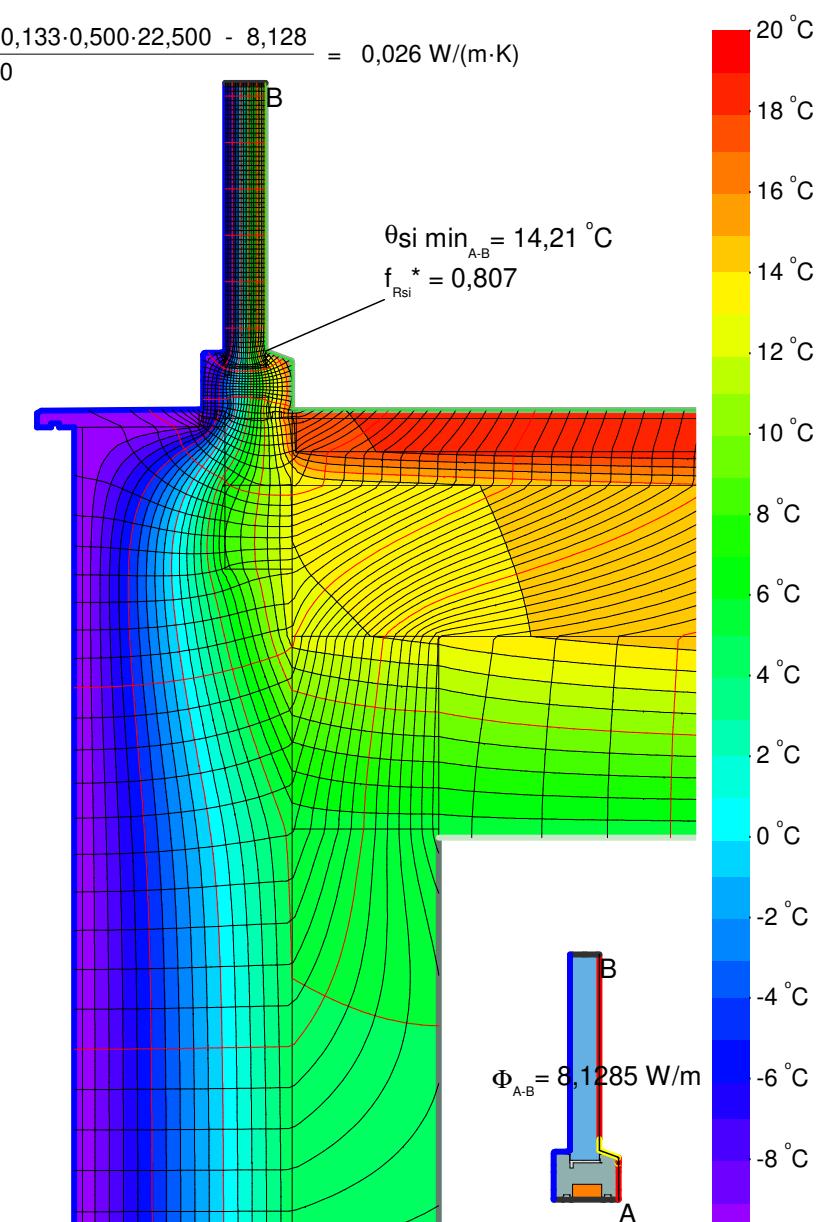
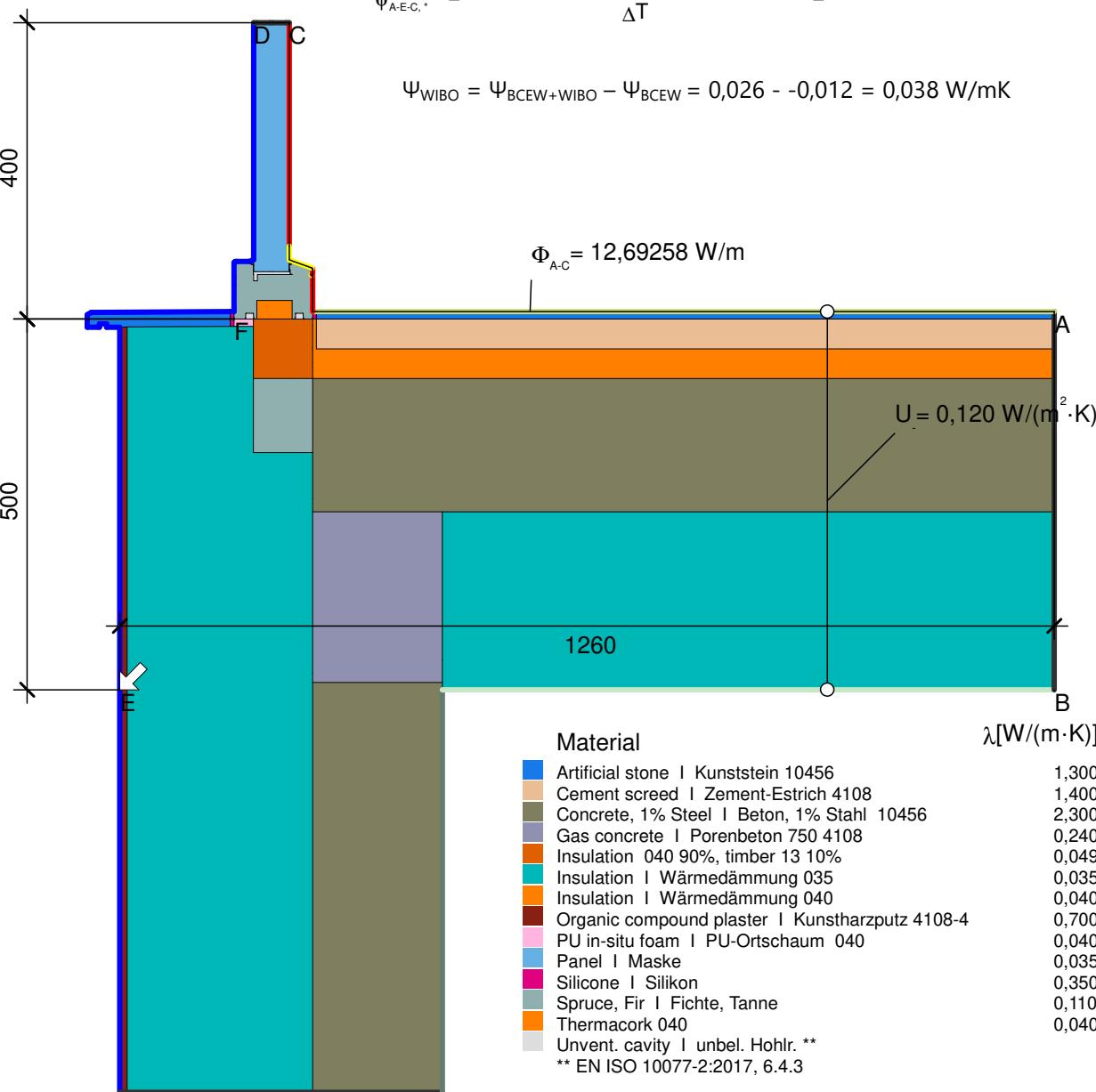
Material	$\lambda[\text{W}/(\text{m} \cdot \text{K})]$	$\epsilon$
EPDM	0,250	0,900
Insulation I Wärmedämmung 035	0,035	0,900
Interior plaster I Gipsputz 10456	0,570	0,900
Organic compound plaster I Kunstharzputz 4108-4	0,700	
PU in-situ foam I PU-Ortschaum 040	0,040	0,900
Panel I Maske	0,035	0,900
Sand-lime stone I Kalksandstein 1745	1,000	
Silicone I Silikon	0,350	0,900
Spruce, Fir I Fichte, Tanne	0,110	0,900
Thermacork 040	0,040	0,900
Unvent. cavity I unbel. Hohlr. **		
slightly vent. cav. I leicht bel. Hohlr. **		
** EN ISO 10077-2:2017, 6.4.3		



Randbedingung	$q[\text{W}/\text{m}^2]$	$\theta[\text{°C}]$	$R[(\text{m}^2 \cdot \text{K})/\text{W}]$	$\epsilon$
Adiabatic I Adiabatisch	0,000			
Adiabatic   Adiabat	0,000			
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



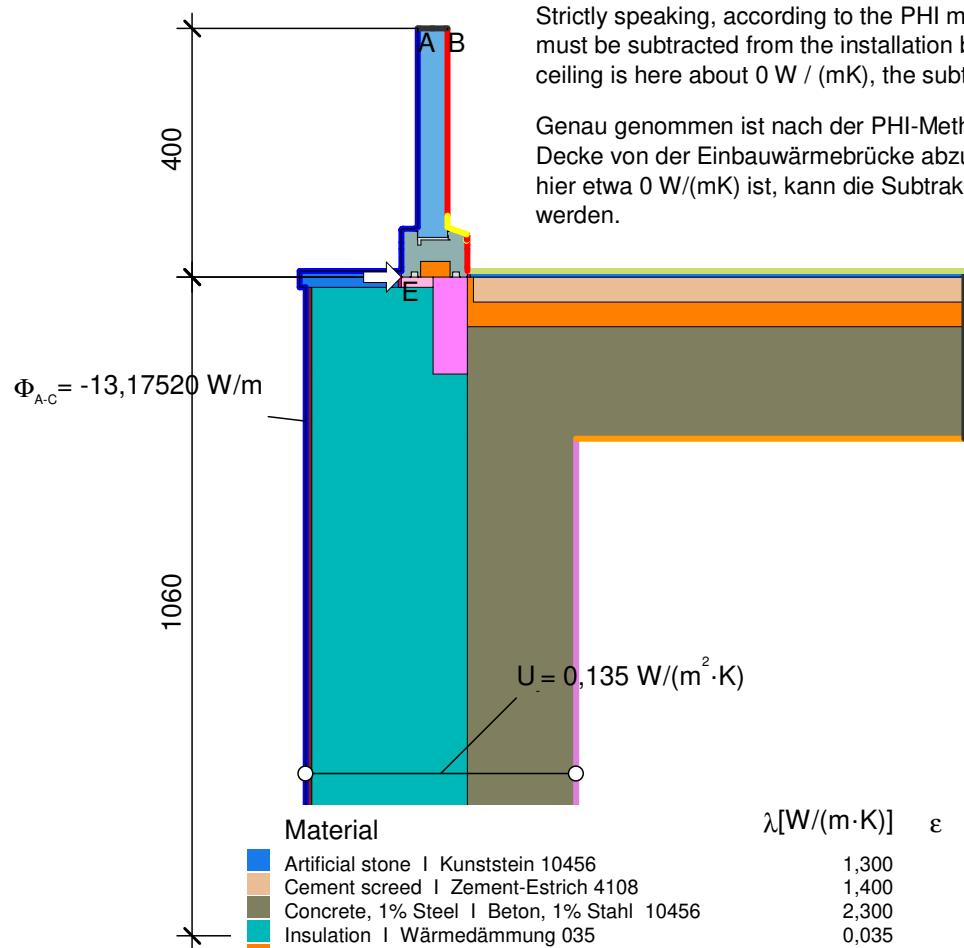




$$\Psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_1}{\Delta T} - U_2 \cdot b_2 = \frac{13,175}{30,000} - \frac{8,128}{30,000} - 0,135 \cdot 1,060 = 0,025 \text{ W/(m}\cdot\text{K)}$$

Strictly speaking, according to the PHI methodology, the thermal bridge of the ceiling must be subtracted from the installation bridge. Since the thermal bridge of the ceiling is here about 0 W / (mK), the subtraction can be neglected in this case.

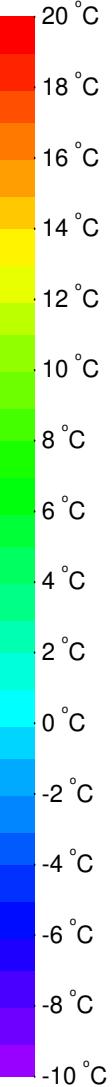
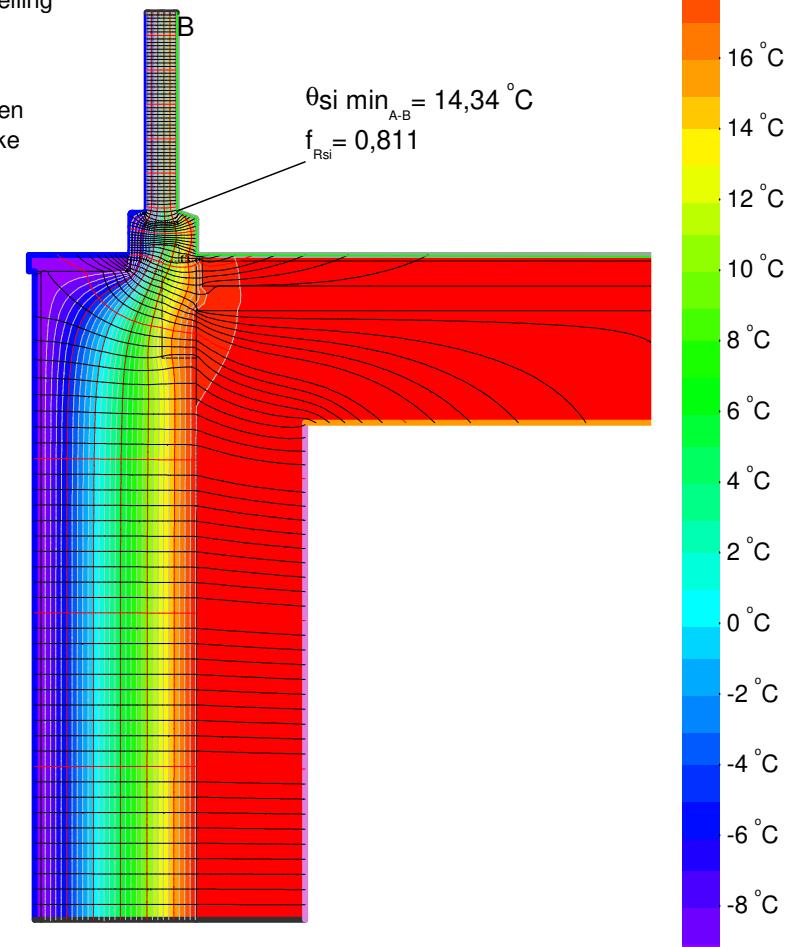
Genau genommen ist nach der PHI-Methodik die Wärmebrücke der einbindenden Decke von der Einbauwärmebrücke abzuziehen. Da die Wärmebrücke der Decke hier etwa 0 W/(mK) ist, kann die Subtraktion hier vereinfachend vernachlässigt werden.



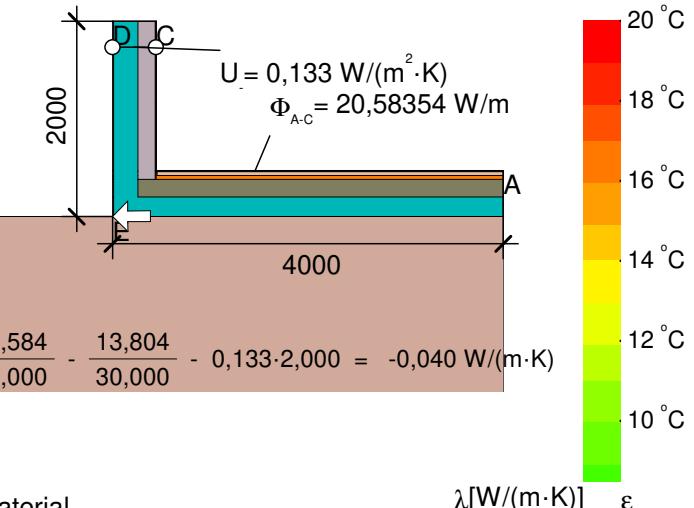
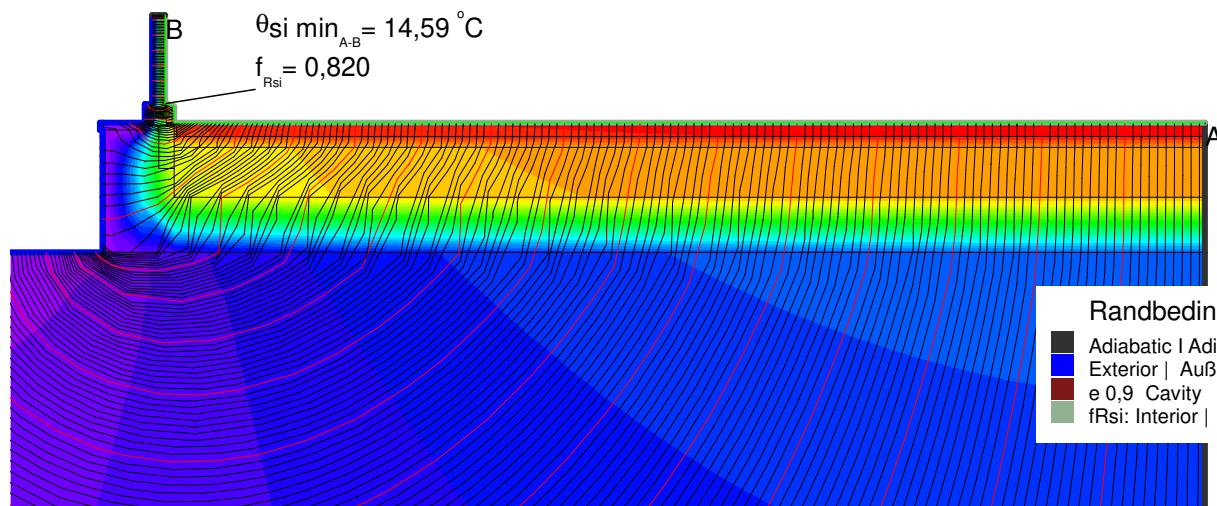
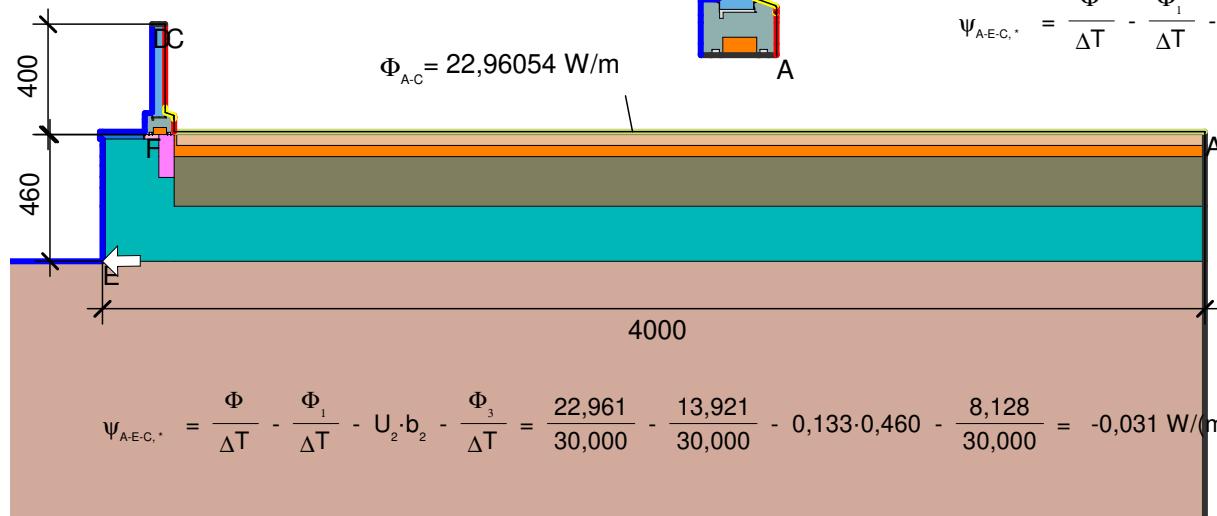
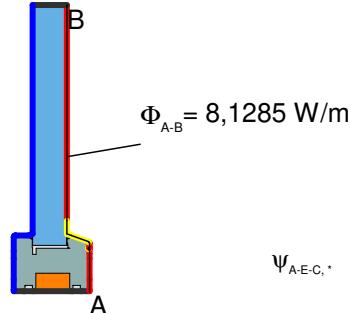
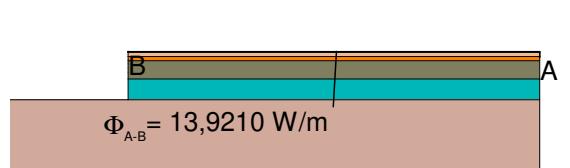
\*\* EN ISO 10777-2:2017, 6.4.3

Material	$\lambda$ [W/(m·K)]	$\epsilon$
Artificial stone   Kunststein 10456	1,300	
Cement screed   Zement-Estrich 4108	1,400	
Concrete, 1% Steel   Beton, 1% Stahl 10456	2,300	
Insulation   Wärmédämmung 035	0,035	
Insulation   Wärmédämmung 040	0,040	
Organic compound plaster   Kunstharpzputz 4108-4	0,700	
PU in-situ foam   PU-Ortschaum 040	0,040	0,900
Panel   Maske	0,035	0,900
Purenit 500 M	0,086	0,900
Silicone   Silikon	0,350	0,900
Spruce, Fir   Fichte, Tanne	0,110	0,900
Thermacork 040	0,040	
Unvent. cavity   unbel. Hohlr. **		

Randbedingung	$q$ [W/m <sup>2</sup> ]	$\theta$ [°C]	$R$ [(m <sup>2</sup> ·K)/W]	$\epsilon$
Adiabatic   Adiabatisch	0,000			
Adiabatic   Adiabat	0,000			
Exterior   Außen	-10,000		0,040	
Int. flux down   Innen abwärts	20,000		0,170	
Interior up.   Innen auf.	20,000		0,100	
Interior   Innen	20,000		0,130	
Interior, frame, normal	20,000		0,130	
Interior, frame, reduced	20,000		0,200	
e 0,9 Cavity   Hohlraum			0,900	

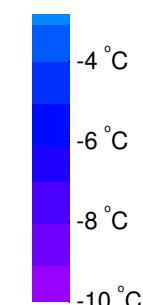
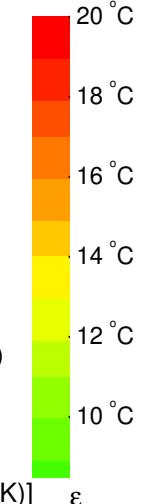


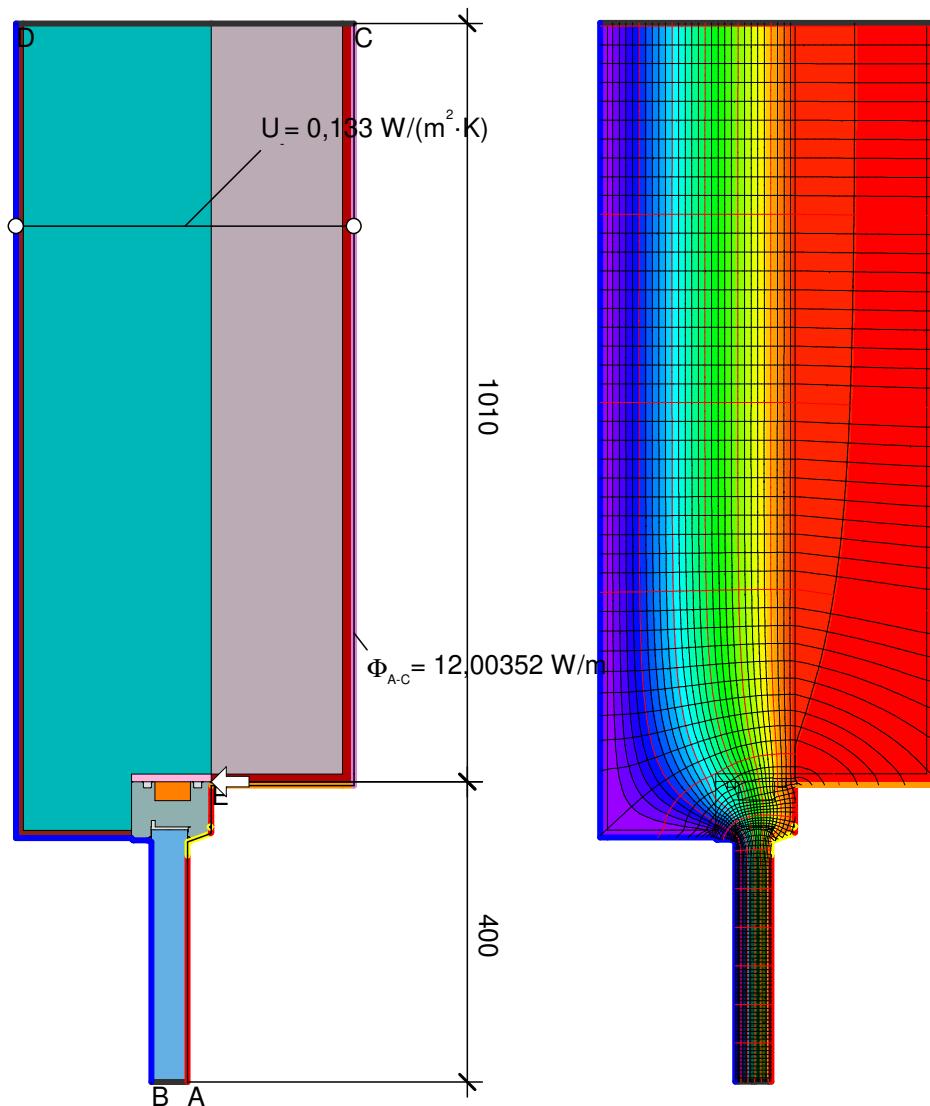
$$\psi_{WITH} = \Psi_{FSEW+WITH} - \Psi_{FSEW} = -0,031 - -0,040 = 0,009 \text{ W/mK}$$



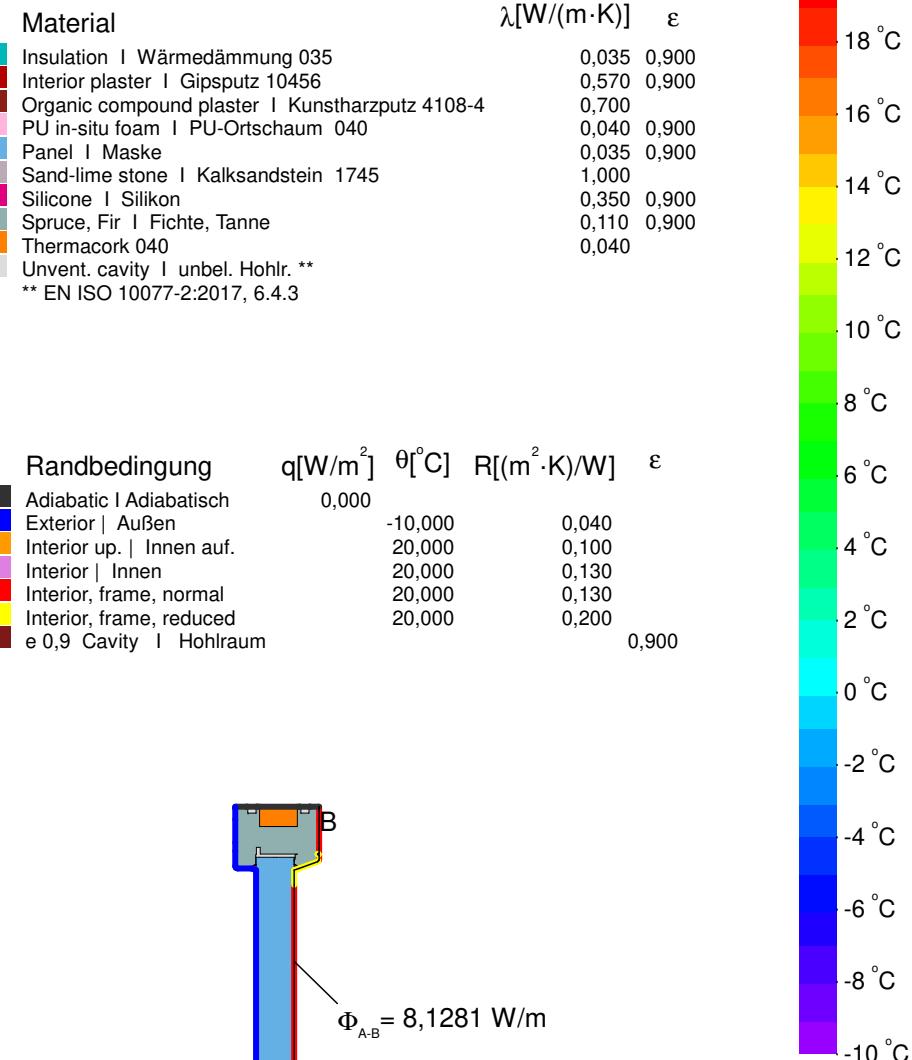
#### Material

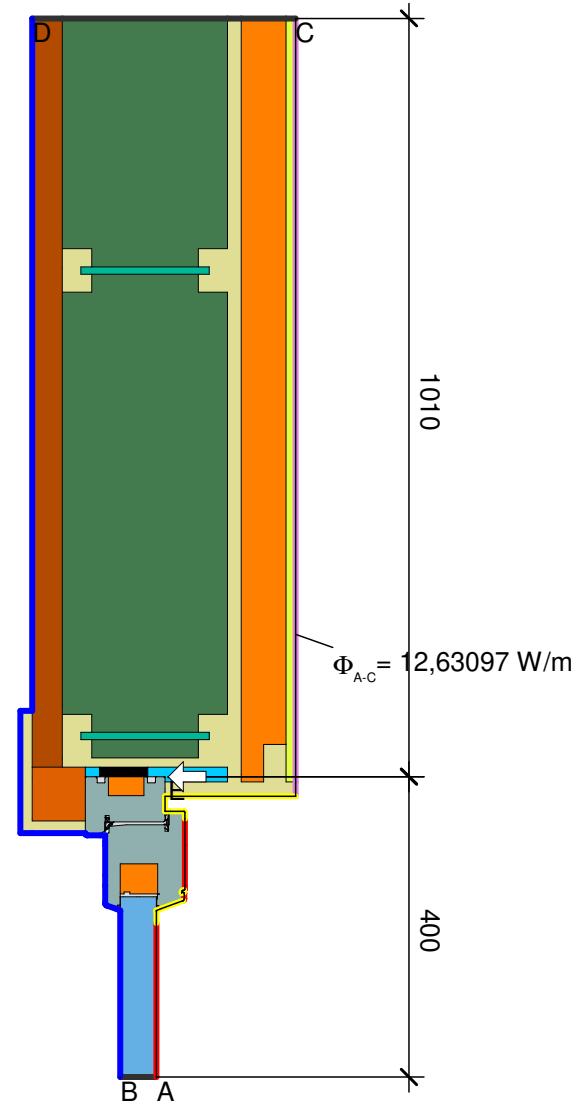
Material	λ[W/(m·K)]	ε
Artificial stone   Kunststein 10456	1,300	
Cement screed   Zement-Estrich 4108	1,400	
Concrete, 1% Steel   Beton, 1% Stahl 10456	2,300	
Ground   Erdreich	2,000	
Insulation   Wärmedämmung 035	0,035	
Insulation   Wärmedämmung 040	0,040	
Organic compound plaster   Kunstharpzputz 4108-4	0,700	
PU in-situ foam   PU-Ortschaum 040	0,040	0,900
Panel   Maske	0,035	0,900
Purenit 500 M	0,086	0,900
Silicone   Silikon	0,350	0,900
Spruce, Fir   Fichte, Tanne	0,110	0,900
Thermacork 040	0,040	
Unvent. cavity   unbel. Hohlr. **		
** EN ISO 10077-2:2017, 6.4.3		



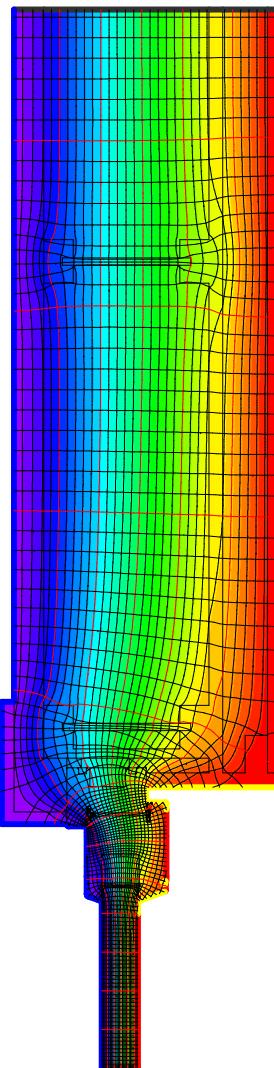


$$\psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_1}{\Delta T} - U \cdot b_2 = \frac{12,004}{30,000} - \frac{8,128}{30,000} - 0,133 \cdot 1,010 = -0,005 \text{ W/(m·K)}$$





$$\Psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_i}{\Delta T} - U_2 \cdot b_2 = \frac{12,631}{30,000} - \frac{8,488}{30,000} - 0,132 \cdot 1,010 = 0,005 \text{ W/(m}\cdot\text{K)}$$

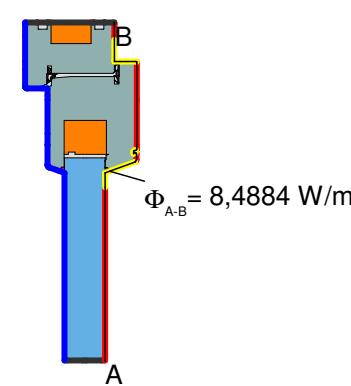


### Material

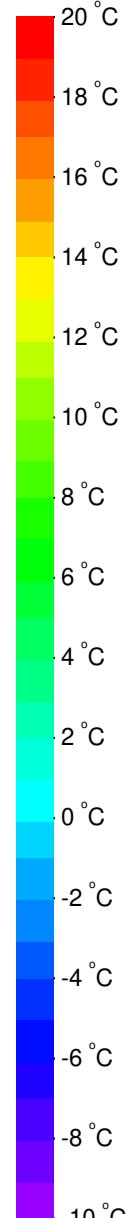
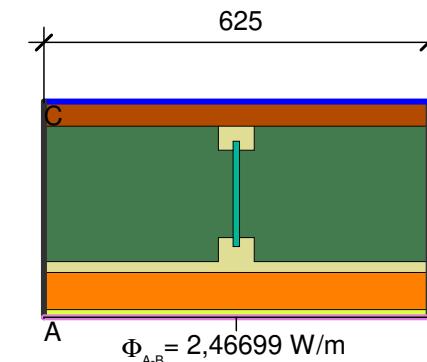
Material	$\lambda[\text{W}/(\text{m}\cdot\text{K})]$	$\epsilon$
Cork   Kork	0,045	0,900
EPDM	0,250	0,900
Gypsum board I Gipskartonplatten 900 kg/m³ 10456	0,250	
Hannoband -3E	0,043	0,900
Insulation I Dämmstoff 040	0,040	
Insulation I Wärmedämmung 040	0,040	
Insulation I Wärmedämmung 050	0,050	
Mineral wool   Mineralwolle 040	0,040	0,900
Panel I Maske	0,035	0,900
Silicone I Silikon	0,350	0,900
Softwood, OSB I Weichholz Q parallel	0,290	
Softwood, OSB I Weichholz, OSB 10456	0,130	
Spruce, Fir I Fichte, Tanne	0,110	0,900
Thermacork 040	0,040	0,900
Unvent. cavity I unbel. Hohlr. **		
slightly vent. cav. I leicht bel. Hohlr. **		
** EN ISO 10077-2:2017, 6.4.3		

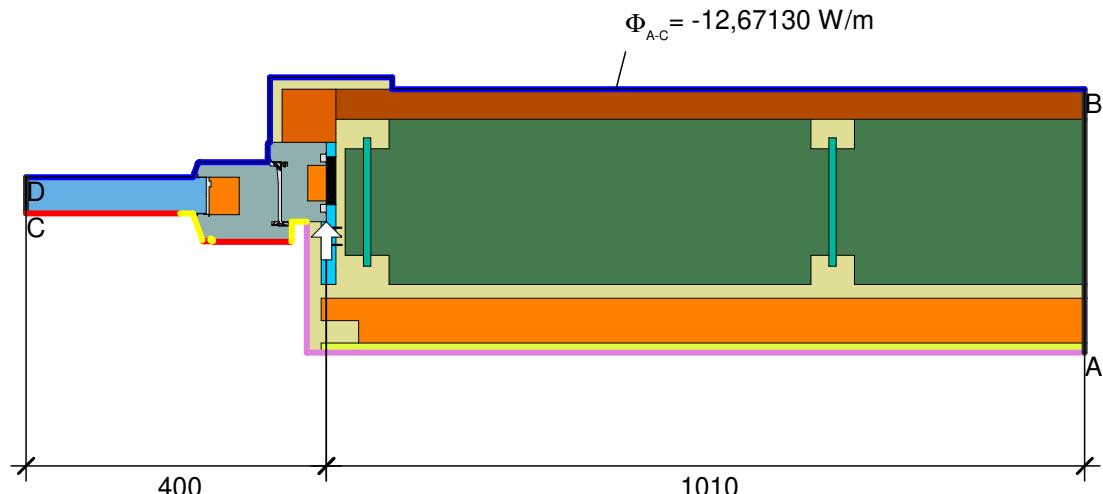
### Randbedingung

Randbedingung	$q[\text{W}/\text{m}^2]$	$\theta[{}^\circ\text{C}]$	$R[(\text{m}^2\cdot\text{K})/\text{W}]$	$\epsilon$
Adiabatic I Adiabatisch	0,000			
Adiabatic   Adiabat	0,000			
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

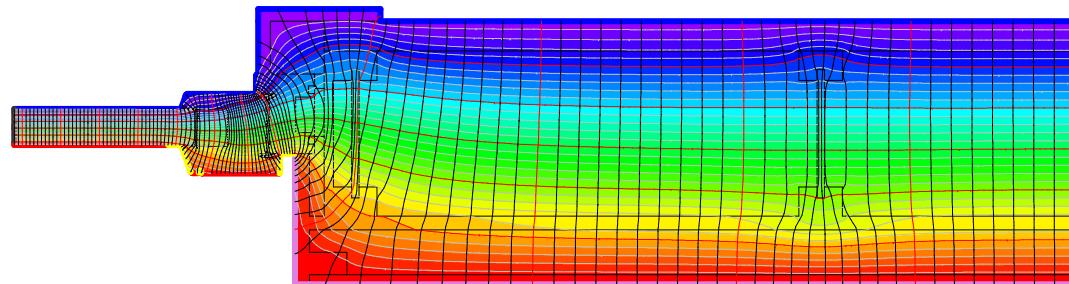


$$U_{eq A-B} = \frac{\Phi}{\Delta T \cdot b} = \frac{2,467}{30,000 \cdot 0,625} = 0,132 \text{ W}/(\text{m}^2\cdot\text{K})$$



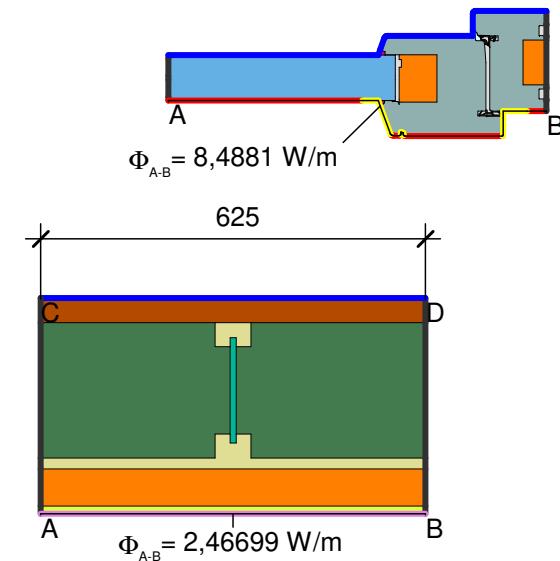


$$\Psi_{AEC} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - \frac{\Phi_2}{\Delta T} = \frac{12,671}{30,000} - 0,132 \cdot 1,010 - \frac{8,488}{30,000} = 0,007 \text{ W/(m·K)}$$



Material	$\lambda[\text{W}/(\text{m} \cdot \text{K})]$	$\epsilon$	20 °C
Cork   Kork	0,045	0,900	18 °C
EPDM	0,250	0,900	16 °C
Gypsum board I Gipskartonplatten 900 kg/m³ 10456	0,250		14 °C
Hannoband -3E	0,043	0,900	12 °C
Insulation I Dämmstoff 040	0,040		10 °C
Insulation I Wärmedämmung 040	0,040		8 °C
Insulation I Wärmedämmung 050	0,050		6 °C
Mineral wool   Mineralwolle 040	0,040	0,900	4 °C
Panel I Maske	0,035	0,900	2 °C
Silicone I Silikon	0,350	0,900	0 °C
Softwood flow parallel I Weichholz Q parallel	0,290		-2 °C
Softwood, OSB I Weichholz, OSB 10456	0,130		-4 °C
Spruce, Fir I Fichte, Tanne	0,110	0,900	-6 °C
Thermacork 040	0,040	0,900	-8 °C
Unvent. cavity I unbel. Hohlr. **			-10 °C
slightly vent. cav. I leicht bel. Hohlr. **			
** EN ISO 10077-2:2017, 6.4.3			

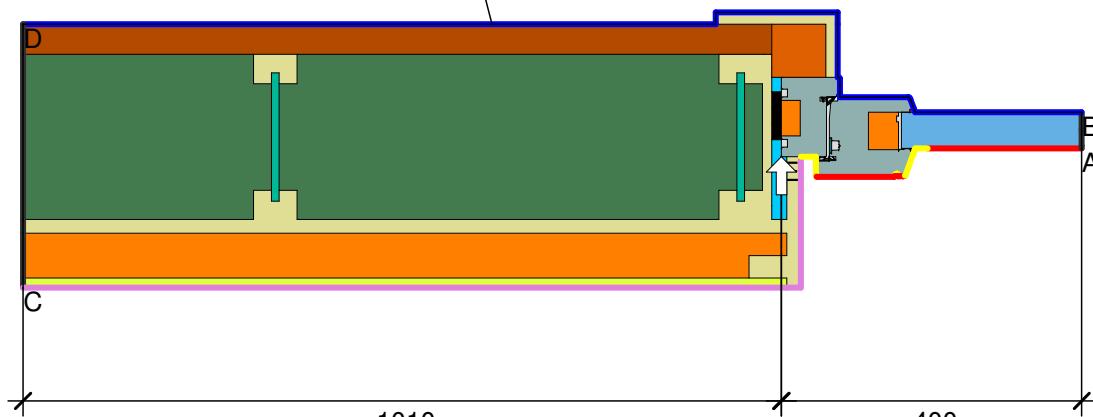
Randbedingung	$q[\text{W}/\text{m}^2]$	$\theta[\text{°C}]$	$R[(\text{m}^2 \cdot \text{K})/\text{W}]$	$\epsilon$
Adiabatic   Adiabatisch	0,000			
Adiabatic   Adiabat	0,000			
Exterior   Außen	-10,000		0,040	
Interior   Innen	20,000		0,130	
Interior, frame, normal	20,000		0,130	
Interior, frame, reduced	20,000		0,200	
e 0,9 Cavity I Hohlraum				0,900



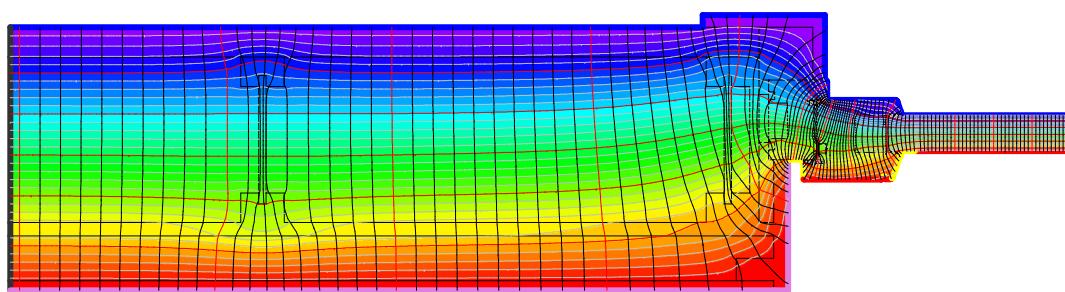
$$U_{eq A-B} = \frac{\Phi}{\Delta T \cdot b} = \frac{2,467}{30,000 \cdot 0,625} = 0,132 \text{ W/(m}^2 \cdot \text{K)}$$



$$\Phi_{A-C} = -12,76358 \text{ W/m}$$



$$\Psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_1}{\Delta T} - U_2 \cdot b_2 = \frac{12,764}{30,000} - \frac{8,584}{30,000} - 0,132 \cdot 1,010 = 0,006 \text{ W/(m}\cdot\text{K)}$$

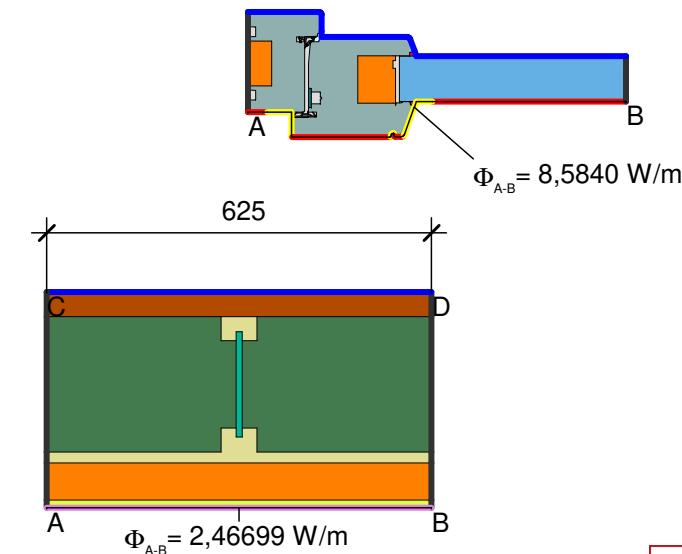


### Material

	$\lambda[\text{W}/(\text{m}\cdot\text{K})]$	$\epsilon$
Cork   Kork	0,045	0,900
EPDM	0,250	0,900
Gypsum board   Gipskartonplatten 900 kg/m³ 10456	0,250	
Hannoband -3E	0,043	0,900
Insulation   Dämmstoff 040	0,040	
Insulation   Wärmedämmung 040	0,040	
Insulation   Wärmedämmung 050	0,050	
Mineral wool   Mineralwolle 040	0,040	0,900
Panel   Maske	0,035	0,900
Silicone   Silikon	0,350	0,900
Softwood flow parallel   Weichholz Q parallel	0,290	
Softwood, OSB   Weichholz, OSB 10456	0,130	
Spruce, Fir   Fichte, Tanne	0,110	0,900
Steel   Stahl	50,000	0,900
Thermacork 040	0,040	0,900
Unvent. cavity   unbel. Hohlr. **		
slightly vent. cav.   leicht bel. Hohlr. **		
** EN ISO 10077-2:2017, 6.4.3		

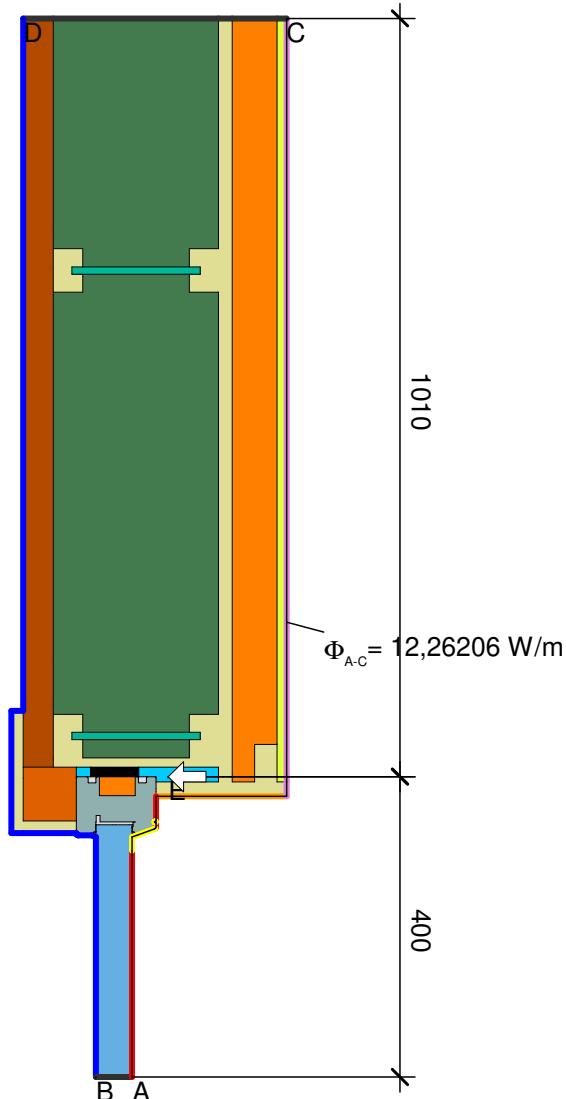
### Randbedingung

	$q[\text{W}/\text{m}^2]$	$\theta[\text{°C}]$	$R[(\text{m}^2\cdot\text{K})/\text{W}]$	$\epsilon$
Adiabatic   Adiabatisch	0,000			
Adiabatic   Adiabat	0,000			
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   Hohlraum				0,900

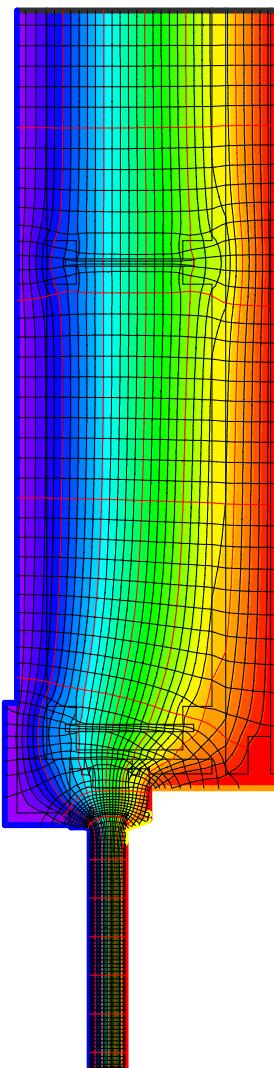


$$U_{\text{eq A-B}} = \frac{\Phi}{\Delta T \cdot b} = \frac{2,467}{30,000 \cdot 0,625} = 0,132 \text{ W}/(\text{m}^2 \cdot \text{K})$$





$$\psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_i}{\Delta T} - U \cdot b_2 = \frac{12,262}{30,000} - \frac{8,128}{30,000} - 0,132 \cdot 1,010 = 0,005 \text{ W/(m}\cdot\text{K)}$$



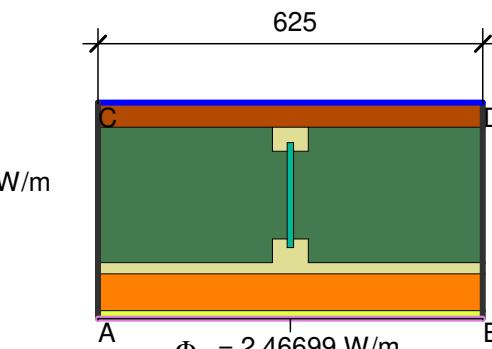
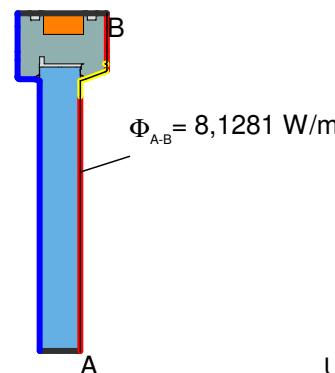
### Material

Material	$\lambda[\text{W}/(\text{m}\cdot\text{K})]$	$\epsilon$
Cork   Kork	0,045	0,900
Gypsum board   Gipskartonplatten 900 kg/m³ 10456	0,250	
Hannoband -3E	0,043	0,900
Insulation   Dämmstoff 040	0,040	
Insulation   Wärmedämmung 040	0,040	
Insulation   Wärmedämmung 050	0,050	
Mineral wool   Mineralwolle 040	0,040	0,900
Panel   Maske	0,035	0,900
Silicone   Silikon	0,350	0,900
Softwood flow parallel   Weichholz Q parallel	0,290	
Softwood, OSB   Weichholz, OSB 10456	0,130	
Spruce, Fir   Fichte, Tanne	0,110	0,900
Thermacork 040	0,040	
Unvent. cavity   unbel. Hohlr. **		

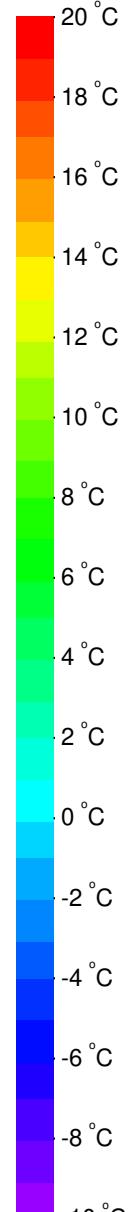
\*\* EN ISO 10077-2:2017, 6.4.3

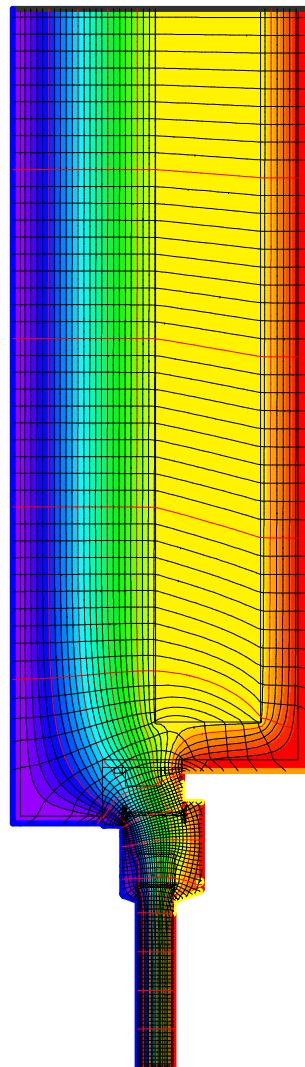
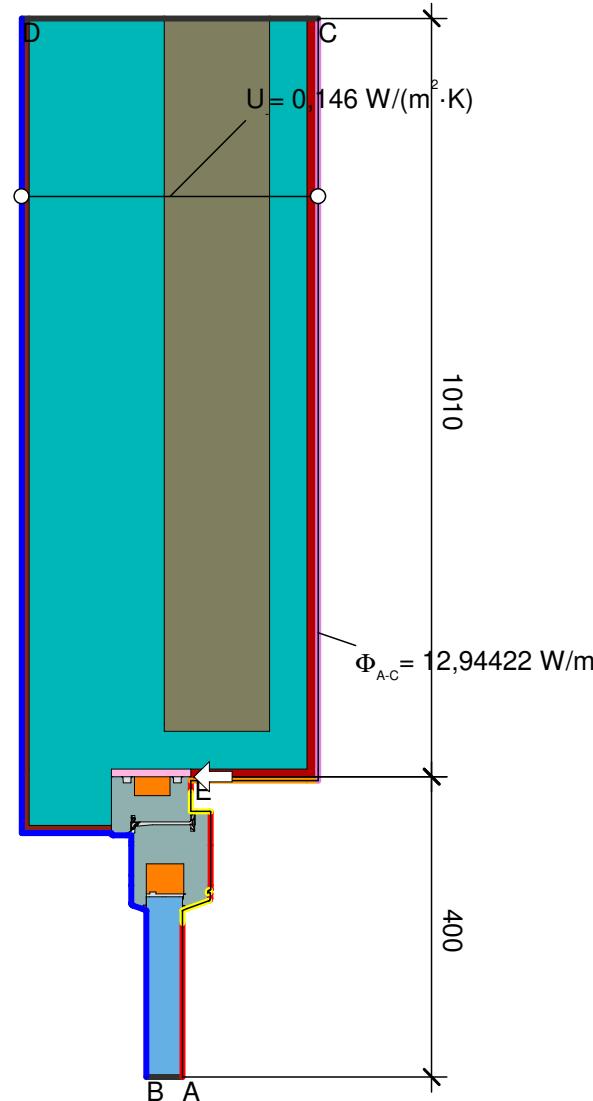
### Randbedingung

Randbedingung	$q[\text{W}/\text{m}^2]$	$\theta[^\circ\text{C}]$	$R[(\text{m}^2\cdot\text{K})/\text{W}]$	$\epsilon$
Adiabatic   Adiabatisch	0,000			
Adiabatic   Adiabat	0,000			
Exterior   Außen	-10,000		0,040	
Interior up.   Innen auf.	20,000		0,100	
Interior   Innen	20,000		0,130	
Interior, frame, normal	20,000		0,130	
Interior, frame, reduced e 0,9 Cavity   Hohlräum	20,000		0,200	
				0,900



$$U_{eq A-B} = \frac{\Phi}{\Delta T \cdot b} = \frac{2,467}{30,000 \cdot 0,625} = 0,132 \text{ W/(m}^2\cdot\text{K)}$$

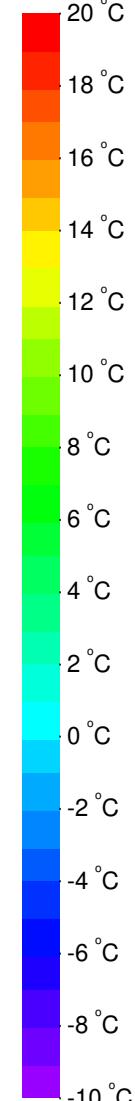




### Material

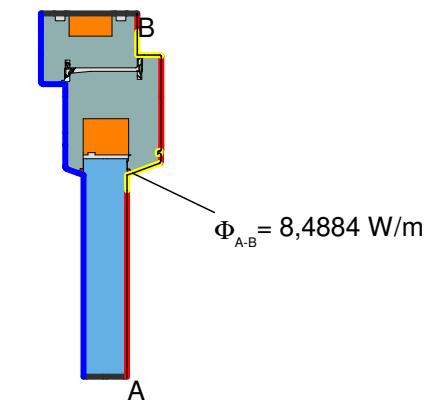
Material	$\lambda[\text{W}/(\text{m}\cdot\text{K})]$	$\epsilon$
Concrete, 1% Steel   Beton, 1% Stahl 10456	2,300	
EPDM	0,250	0,900
Insulation   Wärmedämmung 035	0,035	0,900
Interior plaster   Gipsputz 10456	0,570	0,900
Organic compound plaster   Kunstharzputz 4108-4	0,700	
PU in-situ foam   PU-Ortschaum 040	0,040	0,900
Panel   Maske	0,035	0,900
Silicone   Silikon	0,350	0,900
Spruce, Fir   Fichte, Tanne	0,110	0,900
Thermacork 040	0,040	0,900
Unvent. cavity   unbel. Hohlr. **		
slightly vent. cav.   leicht bel. Hohlr. **		
** EN ISO 10077-2:2017, 6.4.3		

$$\lambda[\text{W}/(\text{m}\cdot\text{K})] \quad \epsilon$$



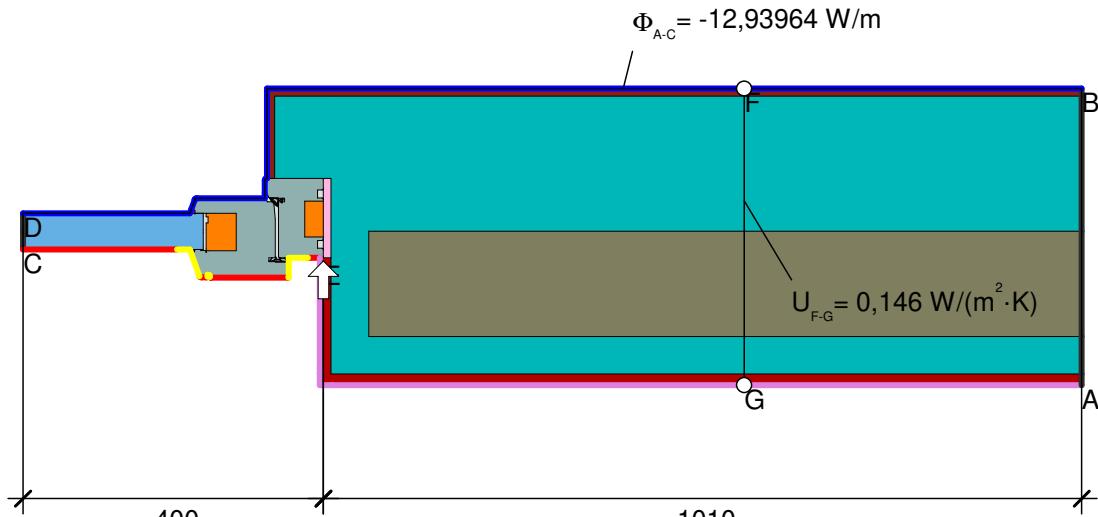
### Randbedingung

Randbedingung	$q[\text{W}/\text{m}^2]$	$\theta[^\circ\text{C}]$	$R[(\text{m}^2\cdot\text{K})/\text{W}]$	$\epsilon$
Adiabatic   Adiabatisch	0,000			
Adiabatic   Adiabat	0,000			
Exterior   Außen	-10,000		0,040	
Interior up.   Innen auf.	20,000		0,100	
Interior   Innen	20,000		0,130	
Interior, frame, normal	20,000		0,130	
Interior, frame, reduced	20,000		0,200	
$\epsilon 0,9$ Cavity   Hohlraum				0,900



$$\psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_1}{\Delta T} - U_2 \cdot b_2 = \frac{12,944}{30,000} - \frac{8,488}{30,000} - 0,146 \cdot 1,010 = 0,001 \text{ W/(m·K)}$$

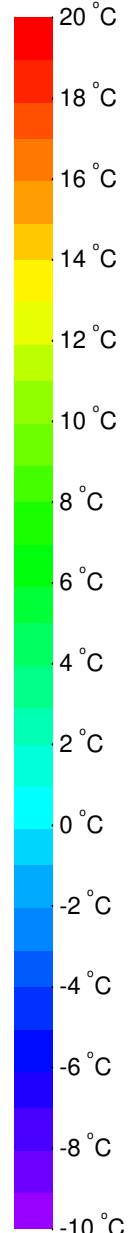
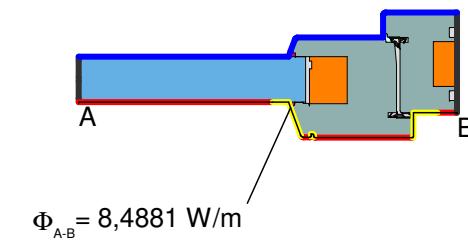
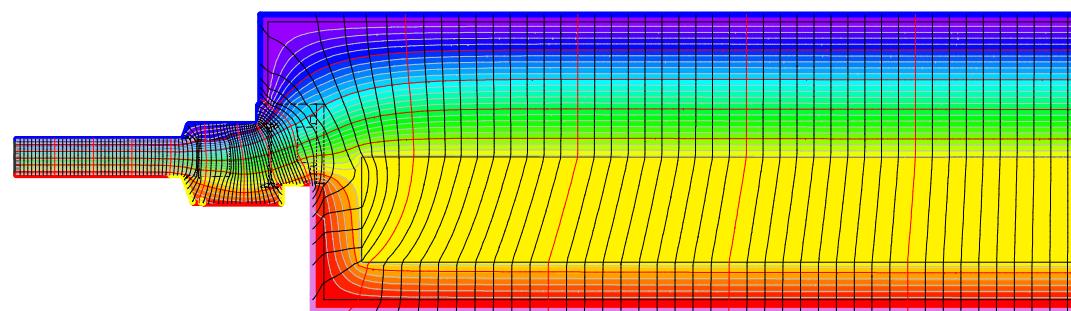


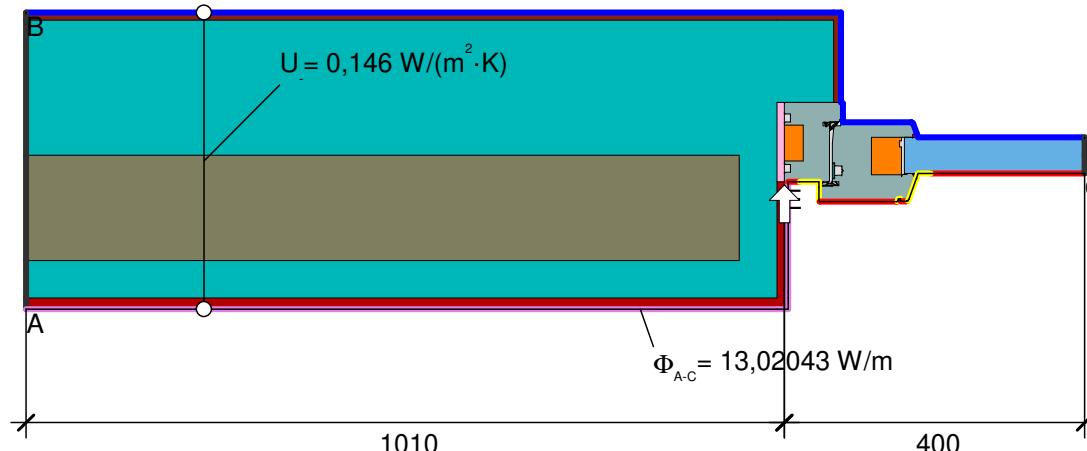


$$\psi_{A-E-C,\cdot} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - \frac{\Phi_2}{\Delta T} = \frac{12,940}{30,000} - 0,146 \cdot 1,010 - \frac{8,488}{30,000} = 0,001 \text{ W}/(\text{m} \cdot \text{K})$$

Material	$\lambda [\text{W}/(\text{m} \cdot \text{K})]$	$\epsilon$
Concrete, 1% Steel   Beton, 1% Stahl 10456	2,300	
EPDM	0,250	0,900
Insulation   Wärmedämmung 035	0,035	0,900
Interior plaster   Gipsputz 10456	0,570	0,900
Organic compound plaster   Kunstharszputz 4108-4	0,700	
PU in-situ foam   PU-Ortschaum 040	0,040	0,900
Panel   Maske	0,035	0,900
Silicone   Silikon	0,350	0,900
Spruce, Fir   Fichte, Tanne	0,110	0,900
Thermacork 040	0,040	0,900
Unvent. cavity   unbel. Hohlr. **		
slightly vent. cav.   leicht bel. Hohlr. **		
** EN ISO 10077-2:2017, 6.4.3		

Randbedingung	$q [\text{W}/\text{m}^2]$	$\theta [{}^\circ\text{C}]$	$R [(\text{m}^2 \cdot \text{K})/\text{W}]$	$\epsilon$
Adiabatic   Adiabatisch	0,000			
Adiabatic   Adiabat	0,000			
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   Hohlraum				0,900

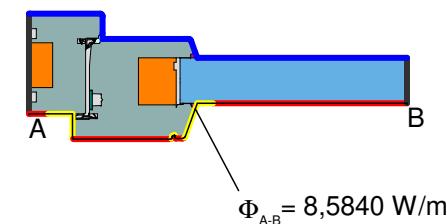
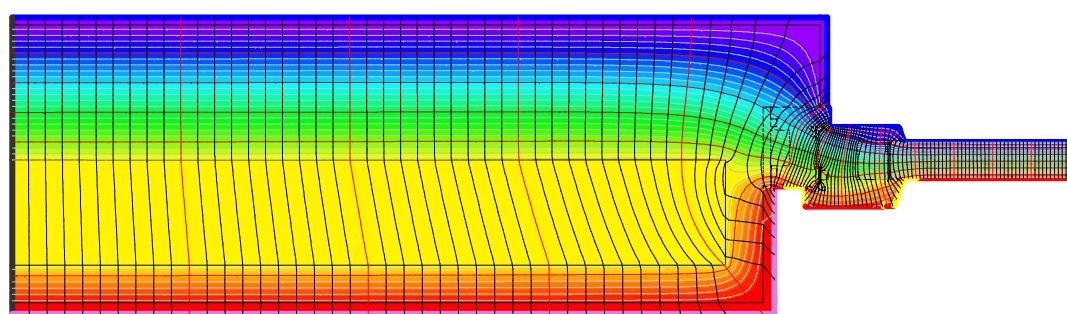


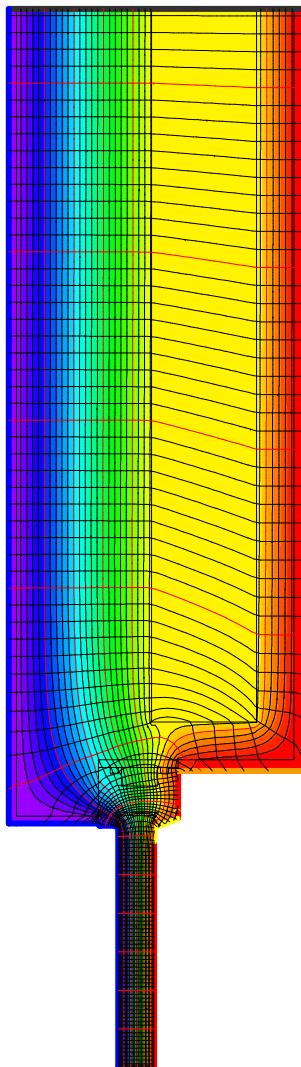
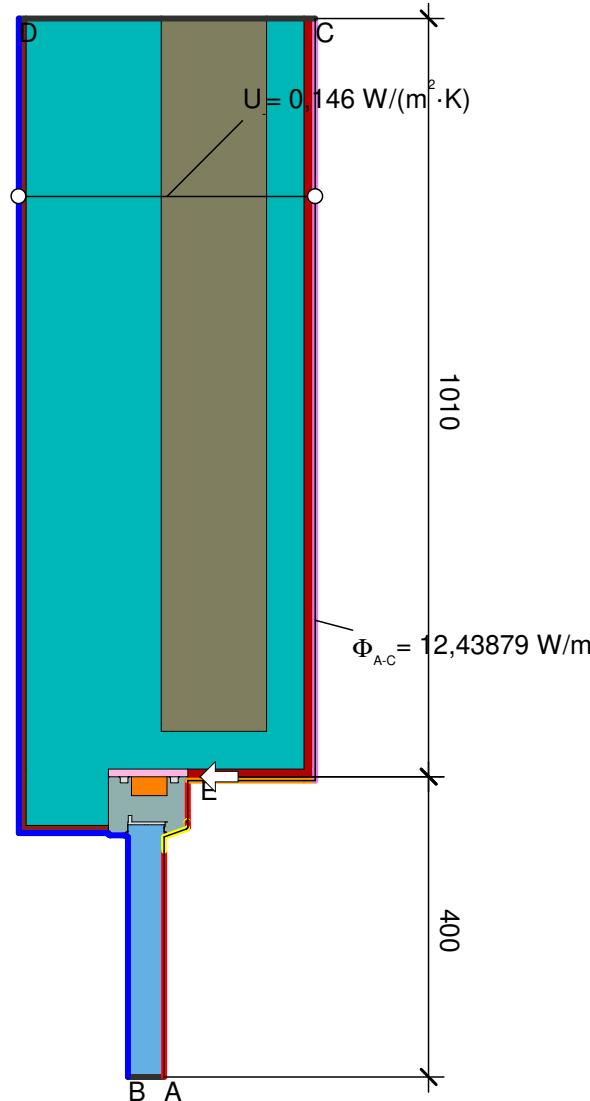


$$\Psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - \frac{\Phi_2}{\Delta T} = \frac{13,020}{30,000} - 0,146 \cdot 1,010 - \frac{8,584}{30,000} = 0,000 \text{ W}/(\text{m}\cdot\text{K})$$

Material	$\lambda [\text{W}/(\text{m}\cdot\text{K})]$	$\epsilon$	20 °C
Concrete, 1% Steel   Beton, 1% Stahl 10456	2,300		18 °C
EPDM	0,250	0,900	16 °C
Insulation   Wärmedämmung 035	0,035	0,900	14 °C
Interior plaster   Gipsputz 10456	0,570	0,900	12 °C
Organic compound plaster   Kunstharzputz 4108-4	0,700		10 °C
PU in-situ foam   PU-Ortschaum 040	0,040	0,900	8 °C
Panel   Maske	0,035	0,900	6 °C
Silicone   Silikon	0,350	0,900	4 °C
Spruce, Fir   Fichte, Tanne	0,110	0,900	2 °C
Steel   Stahl	50,000	0,900	0 °C
Thermacork 040	0,040	0,900	-2 °C
Unvent. cavity   unbel. Hohlr. **			-4 °C
slightly vent. cav.   leicht bel. Hohlr. **			-6 °C
** EN ISO 10077-2:2017, 6.4.3			-8 °C
			-10 °C

Randbedingung	$q [\text{W}/\text{m}^2]$	$\theta [{}^\circ\text{C}]$	$R [(\text{m}^2\cdot\text{K})/\text{W}]$	$\epsilon$
Adiabatic   Adiabatisch	0,000			
Adiabatic   Adiabat	0,000			
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   Hohlraum				0,900



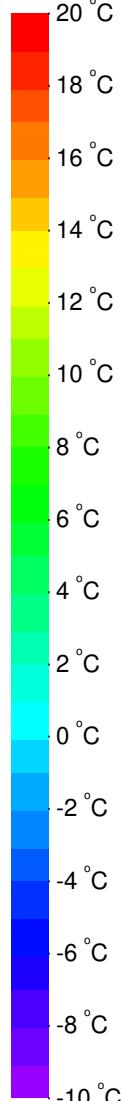


### Material

Material	$\lambda[\text{W}/(\text{m} \cdot \text{K})]$	$\epsilon$
Concrete, 1% Steel   Beton, 1% Stahl 10456	2,300	
Insulation   Wärmedämmung 035	0,035	0,900
Interior plaster   Gipsputz 10456	0,570	0,900
Organic compound plaster   Kunstharzputz 4108-4	0,700	
PU in-situ foam   PU-Ortschaum 040	0,040	0,900
Panel   Maske	0,035	0,900
Silicone   Silikon	0,350	0,900
Spruce, Fir   Fichte, Tanne	0,110	0,900
Thermacork 040	0,040	
Unvent. cavity   unbel. Hohlr.**		

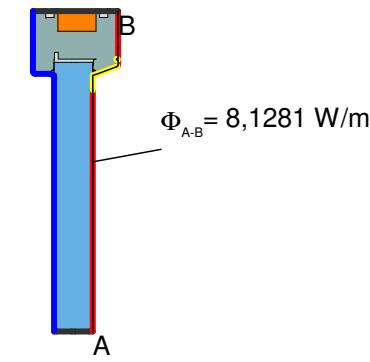
\*\* EN ISO 10077-2:2017, 6.4.3

$$\lambda[\text{W}/(\text{m} \cdot \text{K})] \quad \epsilon$$



### Randbedingung

Randbedingung	$q[\text{W}/\text{m}^2]$	$\theta[^\circ\text{C}]$	$R[(\text{m}^2 \cdot \text{K})/\text{W}]$	$\epsilon$
Adiabatic   Adiabatisch	0,000			
Adiabatic   Adiabat	0,000			
Exterior   Außen	-10,000		0,040	
Interior up.   Innen auf.	20,000		0,100	
Interior   Innen	20,000		0,130	
Interior, frame, normal	20,000		0,130	
Interior, frame, reduced	20,000		0,200	
e 0,9 Cavity   Hohlraum				0,900



$$\Psi_{A-E,C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_1}{\Delta T} - U_2 \cdot b_2 = \frac{12,439}{30,000} - \frac{8,128}{30,000} - 0,146 \cdot 1,010 = -0,004 \text{ W}/(\text{m} \cdot \text{K})$$

