



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

Passive House Institute

Recommended for | Empfohlen für
Cool, temperate climate | Kühl-gemäßigtes Klima



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Product | Produkt:

Client | Auftraggeber:

Spacer | Abstandhalter:

Date | Datum:

Author | Autor:

Rehau Artevo

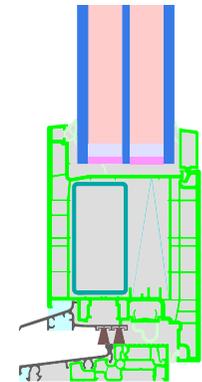
Rehau Industries SE & Co. KG

MULTITECH G

23.03.2026

M. Eng. Johannes Seibert

Entry doors
Haustür
2586ed03



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.

If no radiator is placed near the door, its thermal transmittance U_D (U-value) may not exceed a climate-dependent value in order to prevent unpleasant radiation losses and cold down draughts. This results in restriction of the thermal losses of the door leaf and the frame. In that context, the installation situation of the door in the wall is relevant. Because of that, a $U_{D,installed}$ exemplary tested for the certification has been defined.

Also the hygiene criterion must be met. For reasons of hygiene, this criterion limits the minimum temperature on door surfaces to prevent condensate and mold growth. For the threshold, this value can go under the limit.

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

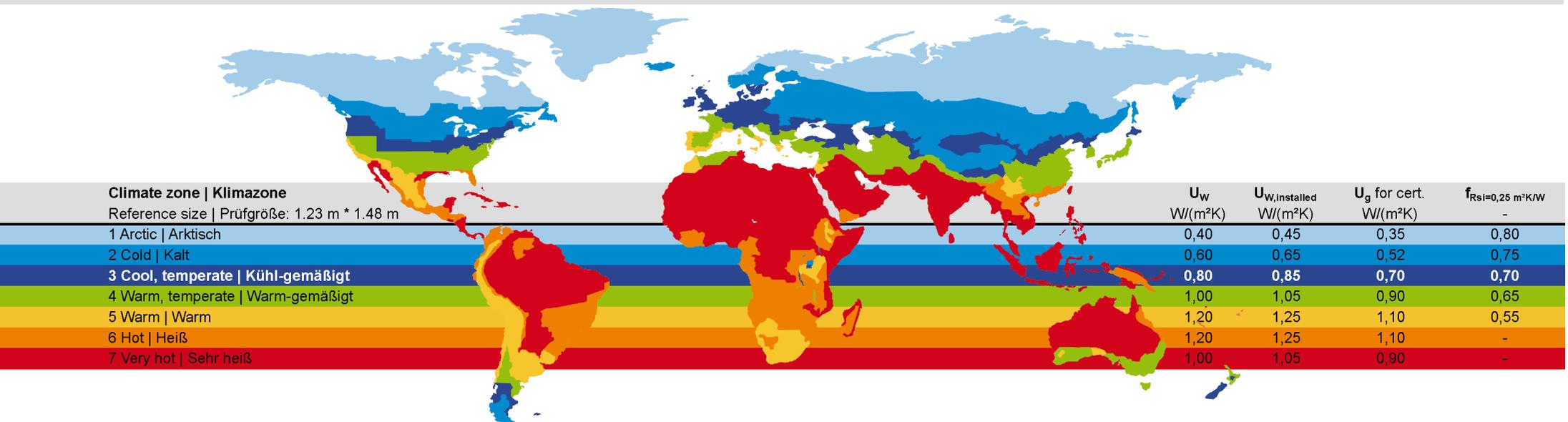
Passivhäuser stellen aufgrund der Möglichkeit, auf ein separates Heizsystem zu verzichten, hohe Anforderungen an die Qualität der verwendeten Bauteile. Dabei steigen die Anforderungen, je kälter das Klima ist. Darum hat das Passivhaus Institut Regionen gleicher Anforderung identifiziert und für diese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

Wird keine gezielte Heizwärmezufuhr nahe der Türen vorgesehen, darf der Wärmedurchgangskoeffizient der

verwendeten Türen (Tür-U-Wert) U_D einen vom Klima abhängigen Höchstwert nicht überschreiten, damit es nicht zu störendem Strahlungswärmeentzug und Kaltluftabfall an der Tür kommt. Daraus ergeben sich Grenzen für den Wärmeverlust im Bereich des Türblattes und des Türrahmens. In diesem Kontext ist auch die Einbausituation der Tür relevant. Darum wurde auch für $U_{D,eingebaut}$ ein Maximalwert festgelegt, der im Rahmen der Zertifizierung beispielhaft geprüft wurde.

Des Weiteren ist das Hygienekriterium zu erfüllen. Dieses Kriterium begrenzt die minimale Einzeltemperatur an der Innenseite der Tür, um Tauwasserausfall und Schimmelbildung zu vermeiden. Im Bereich der Schwelle kann dieser Wert unterschritten werden.

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.

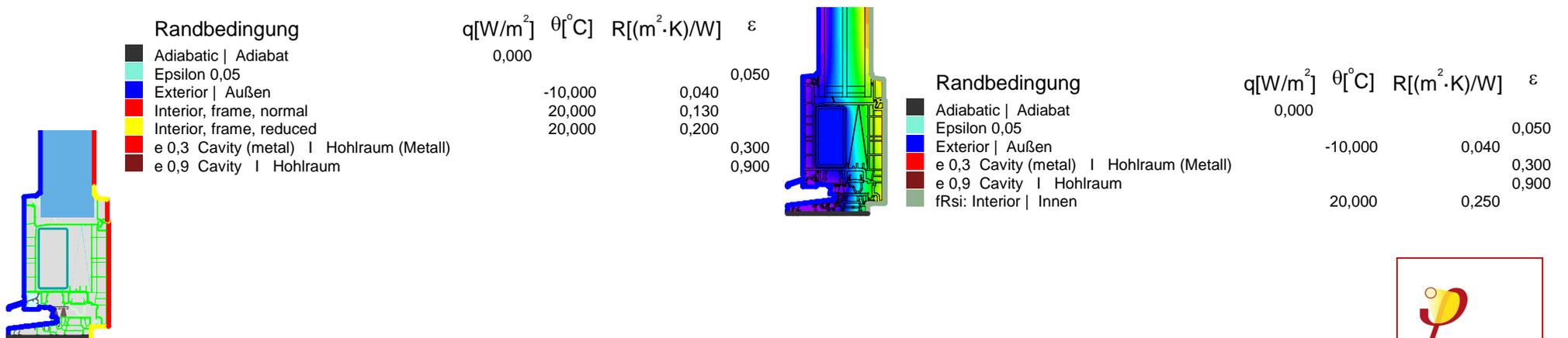
For modeling and simulations, the software Flixo 7 of Infomind was used. For the used **boundary conditions**, please have a look at following drawings and tables.

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.

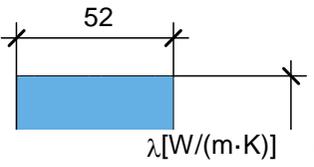
Die **Wärmebrückenverlustkoeffizienten** wurden beispielhaft für typische **Wandaufbauten** berechnet. Diese dürfen in der Gebäudeenergiebilanzierung nur bei identischer Konstruktion zum Ansatz gebracht werden. Die Modelle für Wandaufbauten sind stets 1,41 m hoch, wobei die Höhe des Glases und Rahmens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



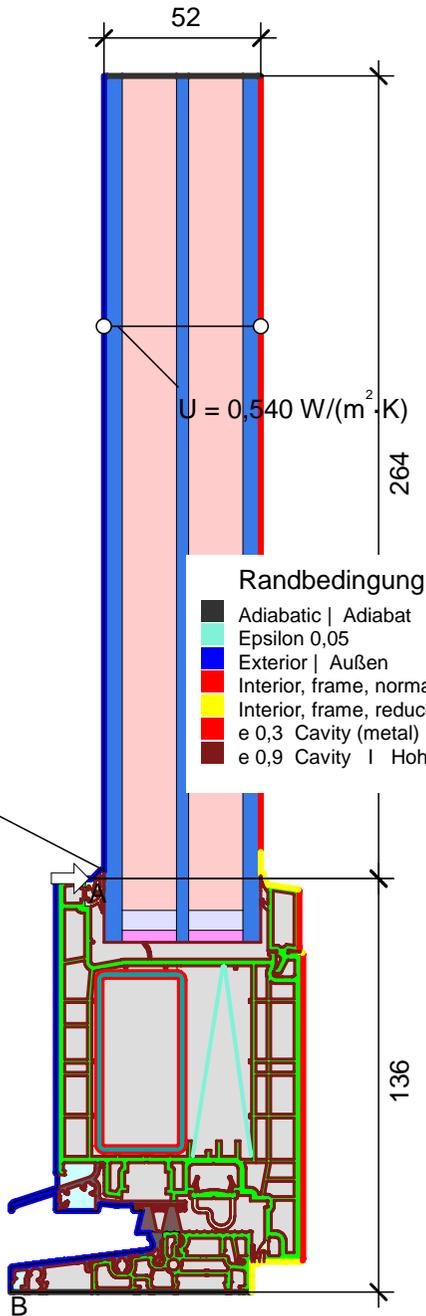
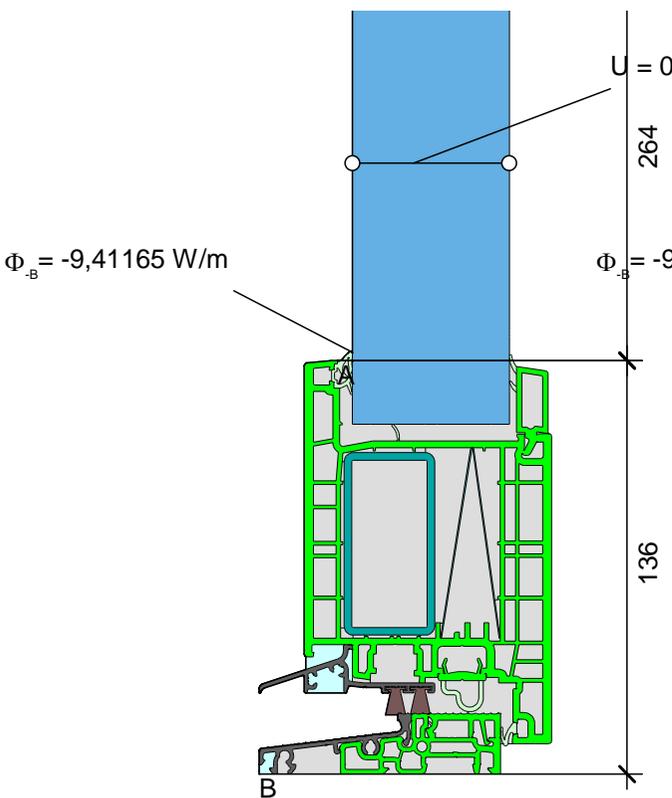
Frame values Rahmenwerte	Rehau Industries SE & Co. KG		OT Threshold	OH Top	OJ Side	SH Side door	FB Bottom fixed	FH Top fixed	FJ Side fixed	FM Flying mullion	1M Mullion	1Ma Mullion	glass junction		
	Rehau Artevo		Schwelle	Oben	Seitl.	Seite Tür	Unten fest	Oben fest	Seitl. fest	Stulp	Pfosten	Pfosten	Glas-einsatz		
	Spacer Abstandhalter: MULTITECH G mit Sekundärdichtung aus Polysulfid														
	Temperaturefactor Temperaturfaktor	$f_{Rsi}=0,25m^2k/W$	0,58	0,71	0,71	0,70									
	Frame width Rahmenbreite	b_f [mm]	136	169	169	169									
	U-value frame Rahmen-U-Wert	U_f [W/(m²K)]	1,13	0,89	0,99	0,92									
	Glazing Glas	U [W/(m²K)]	0,54												
		Thickness Dicke	52 mm												
	Ψ-door leaf or glass edge Türblatt- oder Rahmen-Ψ-Wert	Ψ_{dl} [W/(mK)]	0,030	0,029	0,029	0,029									
	U-value door Tür-U-Wert	U_D [W/(m²K)]	0,78												
Combination Kombination						Description Beschreibung PVC frame with low emissivity bars (e = 5 %) for improving the thermal resistance; Steel reinforcement in the sash and at the lock side also in the blind frame; Maximum Sash dimensions with the chosen reinforcement: 1.05 m * 2.30 m Pane thickness: 52 mm (6/18/4/18/6), rebate depth: 21 mm.									
Installation Einbau	EIFS WDVS U-Wall = 0,133 W/(m²K)		* to unheated basement zu unbeheiztem Keller												
	$\Psi_{install}$ [W/(mK)]		0,025*	-0,008	-0,002	0,001									
	$U_{W, installed}$ [W/(m²K)]		0,78												
	$\Psi_{install}$ [W/(mK)]		0,034	to floor slab zu Bodenplatte											
	$\Psi_{install}$ [W/(mK)]		0,055	to heated storey zu beh. Geschoss											
	Lightweight timber construction Holzleichtbau U-Wall = 0,132 W/(m²K)														
	$\Psi_{install}$ [W/(mK)]		0,025*	0,008	0,012	0,017									
	$U_{W, installed}$ [W/(m²K)]		0,82												
	Formwork blocks Betonschalungsstein U-Wall = 0,146 W/(m²K)		Contact person Ansprechpartner												
	$\Psi_{install}$ [W/(mK)]		0,025*	-0,007	-0,002	0,002									
$U_{W, installed}$ [W/(m²K)]		0,79													
Ventilated facade Vorhangfassade U-Wall = 0,15 W/(m²K)		Calculation Berechnung													
$\Psi_{install}$ [W/(mK)]															
$U_{W, installed}$ [W/(m²K)]															



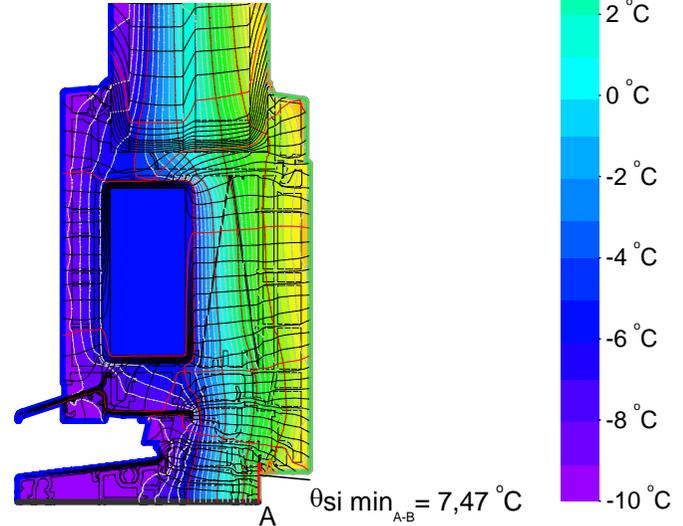
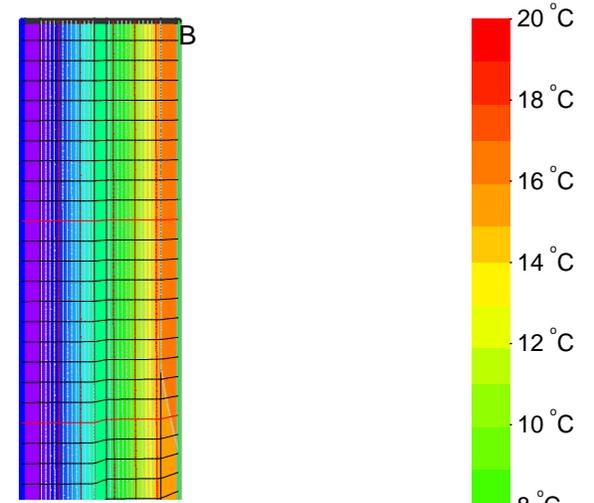


Material	λ [W/(m·K)]	ϵ
Aluminum Aluminium 10456	160,000	0,900
Ar18 in 52 mm U 0,54	0,022	0,900
EPDM	0,250	0,900
Glass Glas	1,000	0,900
MULTITECH G Box 2 [cert] updated	0,140	0,900
Polysulfide Polysulfid	0,400	0,900
Polyvinylchloride (PVC)	0,170	0,900
Polyvinylchloride e = 5 %	0,170	0,050
Soft PVC Weich-PVC	0,140	0,900
Steel Stahl e = 30 %	50,000	0,300
Unvent. cavity unbel. Hohlr. *		
slightly vent. cav. leicht bel. Hohlr. *		

* EN ISO 10077-2:2017, 6.4.3



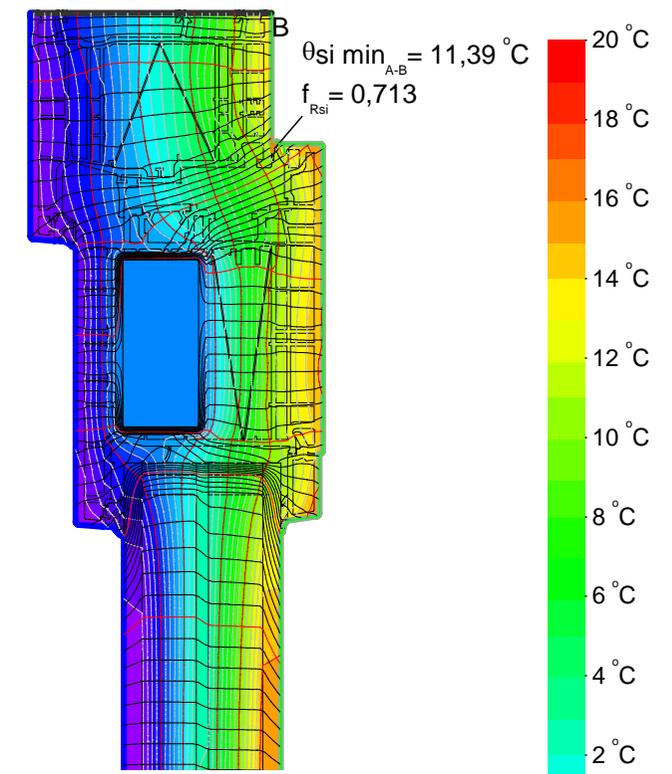
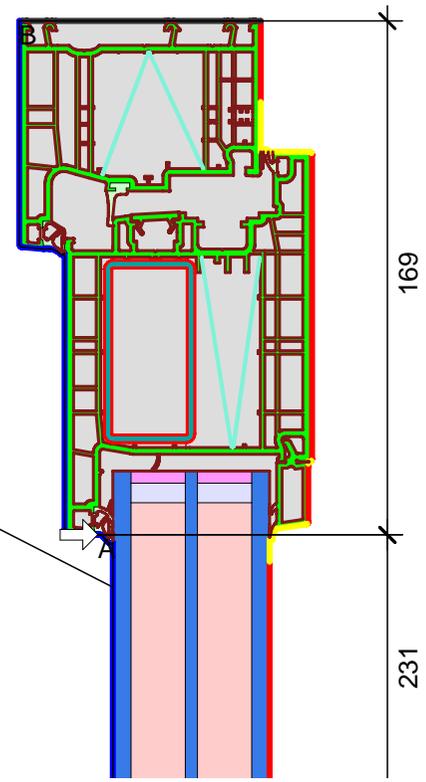
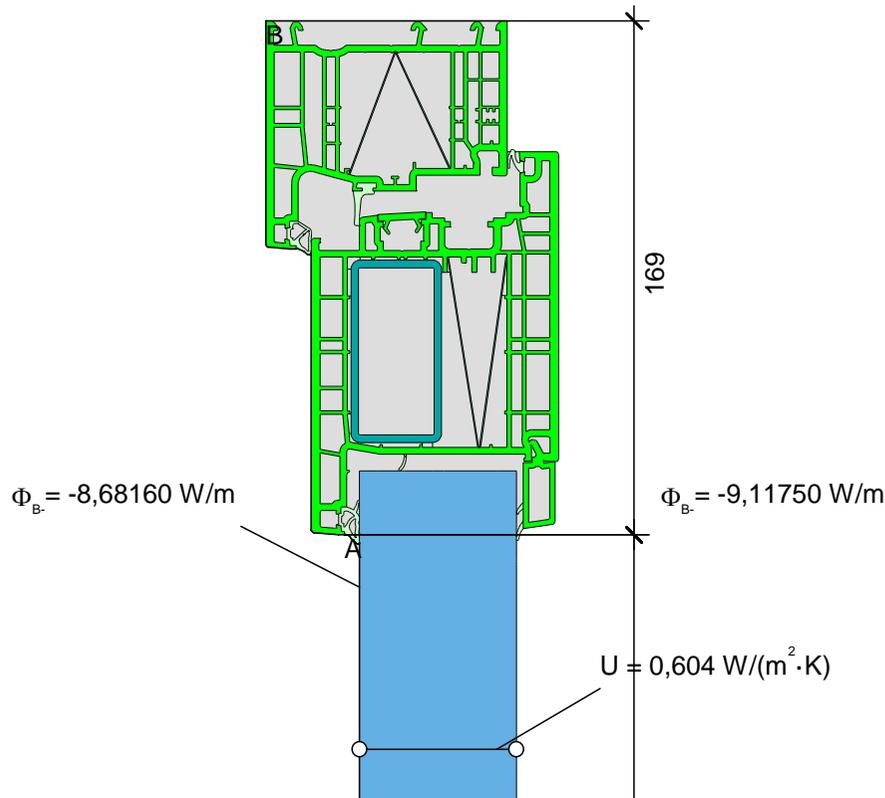
Randbedingung	q [W/m²]	θ [°C]	R [(m²·K)/W]	ϵ
Adiabatic Adiabatisch	0,000			
Epsilon 0,05				0,050
Exterior Außen	-10,000		0,040	
Interior, frame, normal	20,000		0,130	
Interior, frame, reduced	20,000		0,200	
e 0,3 Cavity (metal) Hohlraum (Metall)				0,300
e 0,9 Cavity Hohlraum				0,900



$$U_{f,A,B} = \frac{\Phi}{\Delta T} - U_p \cdot b_p = \frac{9,412}{30,000} - 0,604 \cdot 0,264 = 1,134 \text{ W/(m}^2 \cdot \text{K)}$$

$$\psi_{edA} = \frac{\Phi}{\Delta T} - U_g \cdot b_g - U_f \cdot b_f = \frac{9,809}{30,000} - 0,540 \cdot 0,264 - 1,134 \cdot 0,136 = 0,030 \text{ W/(m}^2 \cdot \text{K)}$$

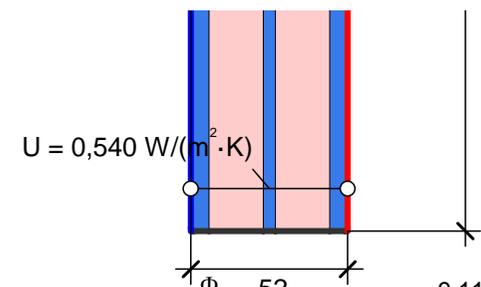




Material	λ [W/(m·K)]	ε
Ar18 in 52 mm U 0,54	0,022	0,900
Glass Glas	1,000	0,900
MULTITECH G Box 2 [cert] updated	0,140	0,900
Polysulfide Polysulfid	0,400	0,900
Polyvinylchloride (PVC)	0,170	0,900
Polyvinylchloride e = 5 %	0,170	0,050
Soft PVC Weich-PVC	0,140	0,900
Steel Stahl e = 30 %	50,000	0,300
Unvent. cavity unbel. Hohlr. *		
* EN ISO 10077-2:2017, 6.4.3		

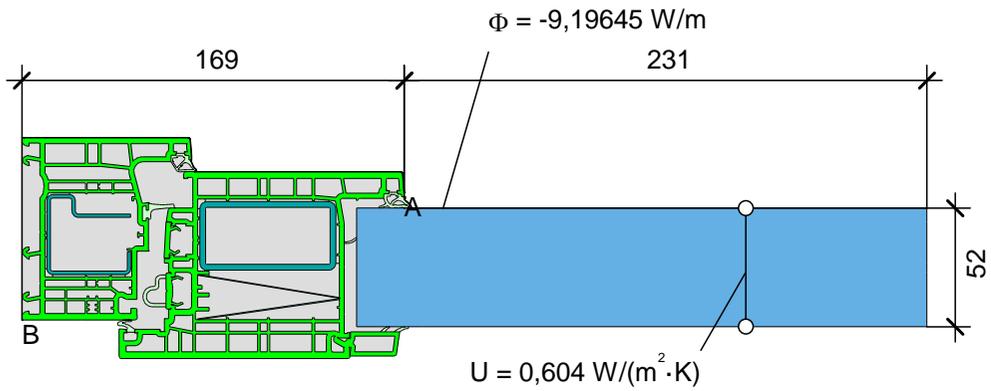
Randbedingung	q [W/m²]	θ [°C]	R [(m²·K)/W]	ε
Adiabatic Adiat	0,000			
Epsilon 0,05				0,050
Exterior Außen	-10,000		0,040	
Interior, frame, normal	20,000		0,130	
Interior, frame, reduced	20,000		0,200	
e 0,3 Cavity (metal) Hohlraum (Metall)				0,300
e 0,9 Cavity Hohlraum				0,900

$$U_{f,A,B} = \frac{\Phi}{b_f} = \frac{\frac{\Phi}{\Delta T} \cdot b_p - U_p \cdot b_p}{b_f} = \frac{\frac{8,682}{30,000} \cdot 52 - 0,604 \cdot 0,231}{0,169} = 0,887 \text{ W/(m}^2 \cdot \text{K)}$$



$$\psi_{edA} = \frac{\Phi}{\Delta T} \cdot \frac{52}{30,000} - U_g \cdot b_g - U_f \cdot b_f = \frac{9,117}{30,000} - 0,540 \cdot 0,231 - 0,887 \cdot 0,169 = 0,029 \text{ W/(m} \cdot \text{K)}$$

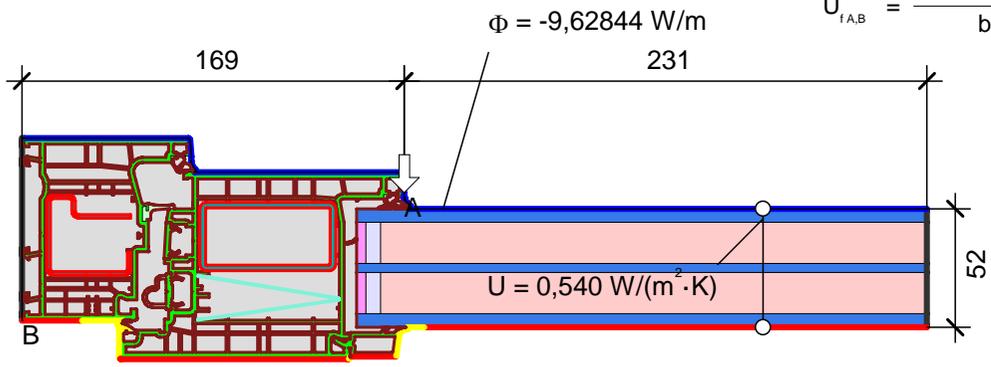




Material	λ [W/(m·K)]	ϵ
Ar18 in 52 mm U 0,54	0,022	0,900
Glass Glas	1,000	0,900
MULTITECH G Box 2 [cert] updated	0,140	0,900
Polysulfide Polysulfid	0,400	0,900
Polyvinylchloride (PVC)	0,170	0,900
Polyvinylchloride e = 5 %	0,170	0,050
Soft PVC Weich-PVC	0,140	0,900
Steel Stahl e = 30 %	50,000	0,300
Unvent. cavity unbel. Hohlr.		*

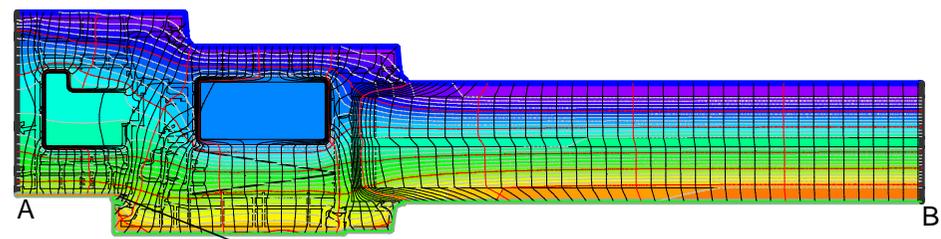
* EN ISO 10077-2:2017, 6.4.3

$$U_{fA,B} = \frac{\frac{\Phi}{\Delta T} - U_p \cdot b_p}{b_f} = \frac{\frac{9,196}{30,000} - 0,604 \cdot 0,231}{0,169} = 0,988 \text{ W/(m}^2 \cdot \text{K)}$$



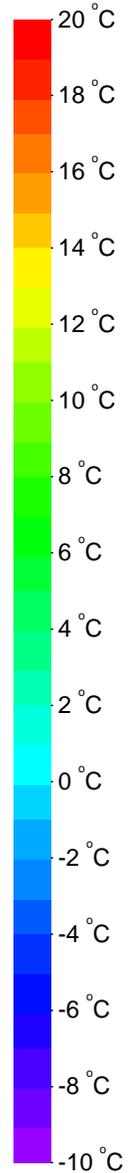
Randbedingung	q [W/m ²]	θ [°C]	R [(m ² ·K)/W]	ϵ
Exterior Außen	-10,000		0,040	
Interior, frame, normal		20,000	0,130	
Interior, frame, reduced		20,000	0,200	
Adiabatic Adiabatic	0,000			
Epsilon 0,05				0,050
e 0,3 Cavity (metal) Hohlraum (Metall)				0,300
e 0,9 Cavity Hohlraum				0,900

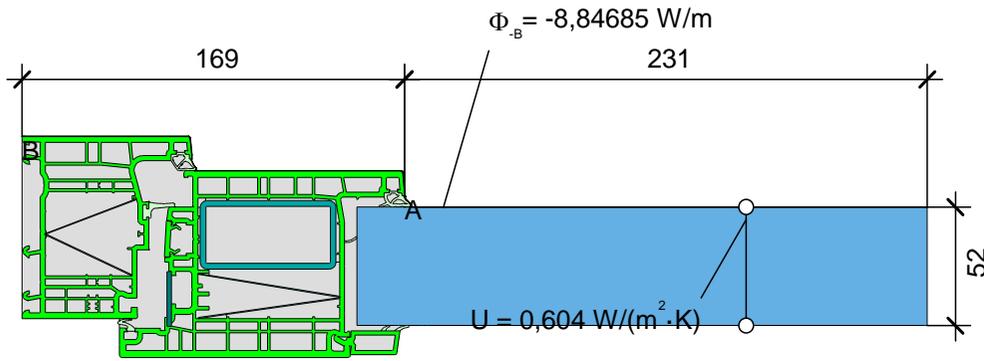
$$\psi_{edA} = \frac{\Phi}{\Delta T} - U_g \cdot b_g - U_f \cdot b_f = \frac{9,628}{30,000} - 0,540 \cdot 0,231 - 0,988 \cdot 0,169 = 0,029 \text{ W/(m}^2 \cdot \text{K)}$$



$\theta_{si \text{ min}}_{A-B} = 11,36 \text{ }^\circ\text{C}$
 $f_{Rsi} = 0,712$

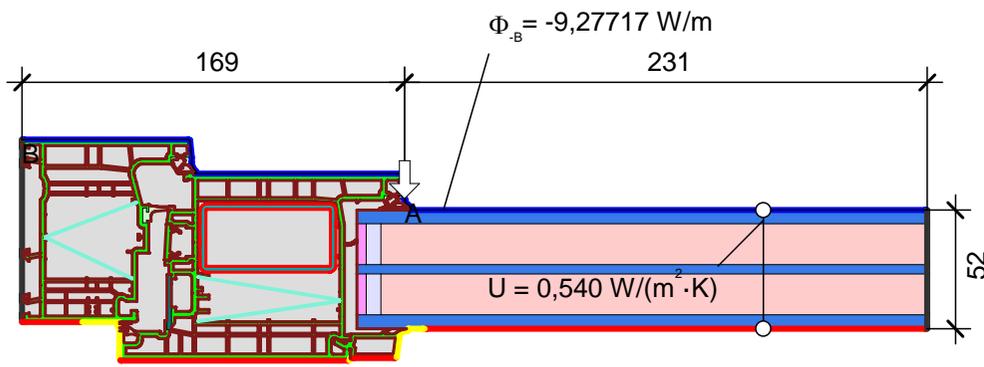
Randbedingung	q [W/m ²]	θ [°C]	R [(m ² ·K)/W]	ϵ
Exterior Außen	-10,000		0,040	
fRsi: Interior Innen		20,000	0,250	
Adiabatic Adiabatic	0,000			
Epsilon 0,05				0,050
e 0,3 Cavity (metal) Hohlraum (Metall)				0,300
e 0,9 Cavity Hohlraum				0,900





Material	$\lambda[\text{W}/(\text{m} \cdot \text{K})]$	ϵ
Ar18 in 52 mm U 0,54	0,022	0,900
Glass Glas	1,000	0,900
MULTITECH G Box 2 [cert] updated	0,140	0,900
Polysulfide Polysulfid	0,400	0,900
Polyvinylchloride (PVC)	0,170	0,900
Polyvinylchloride $\epsilon = 5 \%$	0,170	0,050
Soft PVC Weich-PVC	0,140	0,900
Steel Stahl	50,000	0,900
Steel Stahl $\epsilon = 30 \%$	50,000	0,300
Unvent. cavity unbel. Hohlr.		*

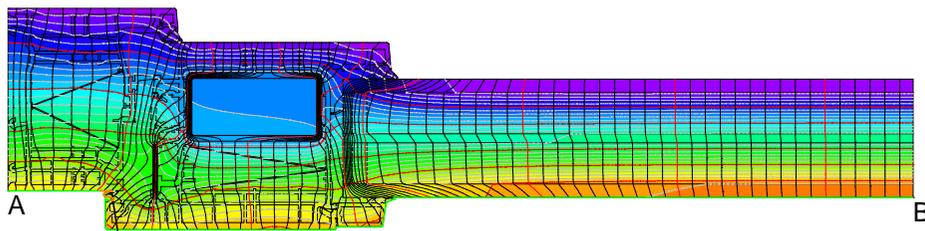
* EN ISO 10077-2:2017, 6.4.3



$$U_{fA,B} = \frac{\frac{\Phi}{\Delta T} - U_p \cdot b_p}{b_f} = \frac{\frac{8,847}{30,000} - 0,604 \cdot 0,231}{0,169} = 0,919 \text{ W}/(\text{m}^2 \cdot \text{K})$$

Randbedingung	$q[\text{W}/\text{m}^2]$	$\theta[^\circ\text{C}]$	$R[(\text{m}^2 \cdot \text{K})/\text{W}]$	ϵ
Exterior Außen	-10,000		0,040	
Interior, frame, normal		20,000	0,130	
Interior, frame, reduced		20,000	0,200	
Adiabatic Adiabat	0,000			
Epsilon 0,05				0,050
e 0,3 Cavity (metal) Hohlraum (Metall)				0,300
e 0,9 Cavity Hohlraum				0,900

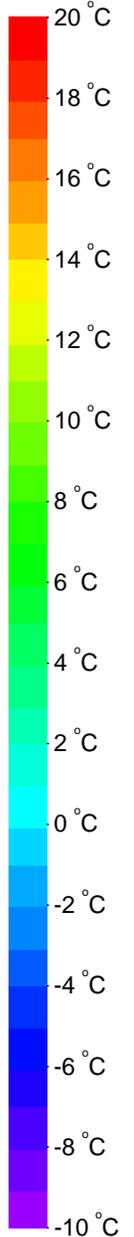
$$\psi_{edA} = \frac{\Phi}{\Delta T} - U_g \cdot b_g - U_f \cdot b_f = \frac{9,277}{30,000} - 0,540 \cdot 0,231 - 0,919 \cdot 0,169 = 0,029 \text{ W}/(\text{m} \cdot \text{K})$$



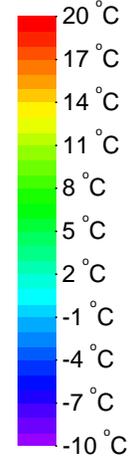
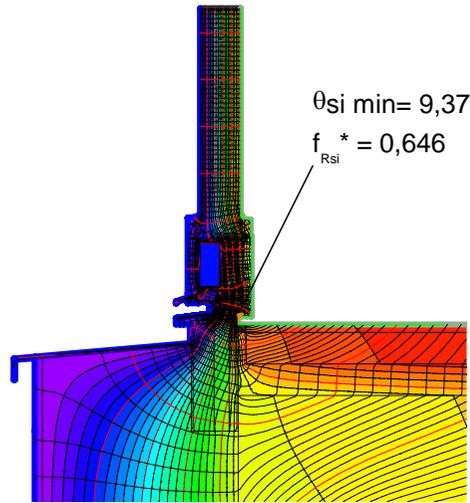
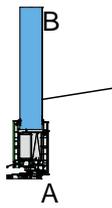
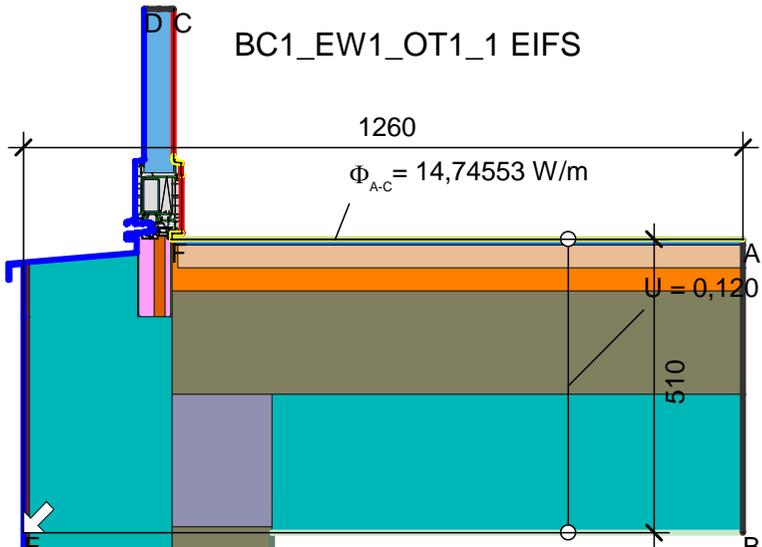
Randbedingung	$q[\text{W}/\text{m}^2]$	$\theta[^\circ\text{C}]$	$R[(\text{m}^2 \cdot \text{K})/\text{W}]$	ϵ
Exterior Außen	-10,000		0,040	
fRsi: Interior Innen		20,000	0,250	
Adiabatic Adiabat	0,000			
Epsilon 0,05				0,050
e 0,3 Cavity (metal) Hohlraum (Metall)				0,300
e 0,9 Cavity Hohlraum				0,900

$\theta_{si \min}_{A-B} = 11,13 \text{ }^\circ\text{C}$

$f_{Rsi} = 0,704$



BC1_EW1_OT1_1 EIFS



Randbedingung

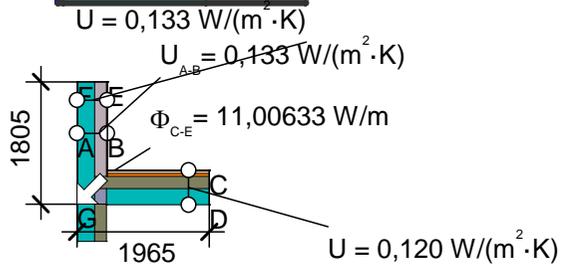
Exterior Außen	-10,000	0,040
Int. flux down Innen abwärts	20,000	0,170
Int. unheated Innen unbeheizt	5,000	0,130
Int. unheated down Innen unbeheizt abwärts	5,000	0,170
Interior, frame, normal	20,000	0,130
Interior, frame, reduced	20,000	0,200
Adiabatic Adiat	0,000	
Epsilon 0,05		0,050
e 0,3 Cavity (metal) Hohlraum (Metall)		0,300
e 0,9 Cavity Hohlraum		0,900

q[W/m ²]	θ[°C]	R[(m ² ·K)/W]	ε
	-10,000	0,040	
	20,000	0,170	
	5,000	0,130	
	5,000	0,170	
	20,000	0,130	
	20,000	0,200	
0,000			0,050
			0,300
			0,900

Material

Material	λ[W/(m·K)]	ε
Aluminum Aluminium 10456	160,000	0,900
Artificial stone Kunststein 10456	1,300	0,900
Cement screed Zement-Estrich 4108	1,400	0,900
Concrete, 1% Steel Beton, 1% Stahl 10456	2,300	0,900
EPDM	0,250	0,900
Gas concrete Porenbeton 750 4108	0,240	0,900
Insulation Wärmedämmung 035	0,035	0,900
Insulation Wärmedämmung 040	0,040	0,900
Luftschicht, ruhend, horizontal, Dicke: 5 mm	0,046	0,900
Organic compound plaster Kunstharzputz 4108-4	0,700	0,900
Panel Maske	0,035	0,900
Polyvinylchloride (PVC)	0,170	0,900
Polyvinylchloride e = 5 %	0,170	0,050
Rodenberg PE XPS 032	0,035	0,900
Rodenberg Porta CELL	0,070	0,900
Silicone Silikon	0,350	0,900
Soft PVC Weich-PVC	0,140	0,900
Steel Stahl e = 30 %	50,000	0,300
Unvent. cavity unbel. Hohlr. *		
slightly vent. cav. leicht bel. Hohlr. *		

* EN ISO 10077-2:2017, 6.4.3



$$\Psi_{C-G-E} = \frac{\Phi - U_1 \cdot b_1 \cdot \Delta T_1 - U_2 \cdot b_2 \cdot \Delta T_2}{\Delta T} = \frac{11,006 - 0,120 \cdot 1,965 \cdot 15,000 - 0,133 \cdot 1,805 \cdot 30,000}{30,000} = 0,009 \text{ W/(m·K)}$$

$$\Psi_{A-E-C,*} = \frac{\Phi - U_1 \cdot b_1 \cdot \Delta T_1 - U_2 \cdot b_2 \cdot \Delta T_2 - \Phi_3}{\Delta T} = \frac{14,746 - 0,120 \cdot 1,260 \cdot 15,000 - 0,133 \cdot 0,510 \cdot 30,000 - 9,412}{30,000} = 0,034 \text{ W/(m·K)}$$

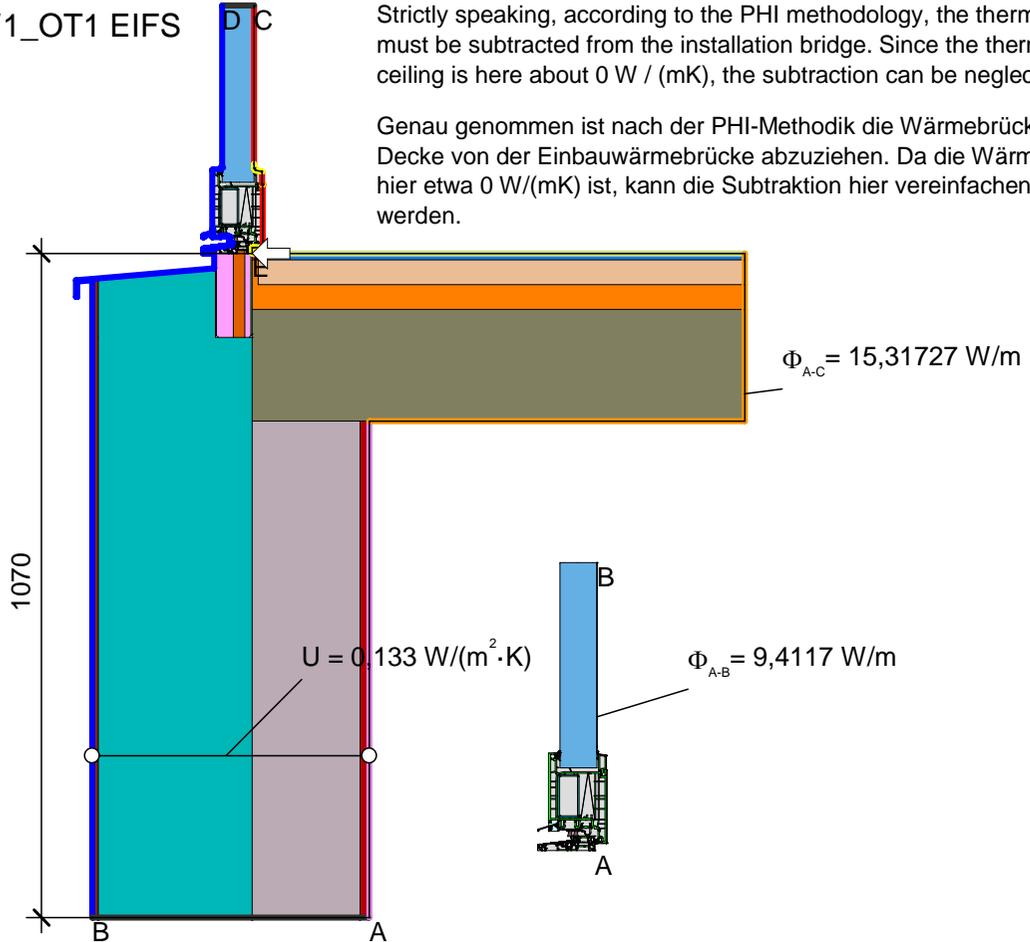
$$\Psi_{BC1_EW1_OT1} = \Psi_{(BC1_EW1_OT1+1 + BC1_EW1_1)} - \Psi_{BC1_EW1_1} = 0,034 - 0,009 = 0,025 \text{ W/(mK)}$$



EW1_OT1 EIFS

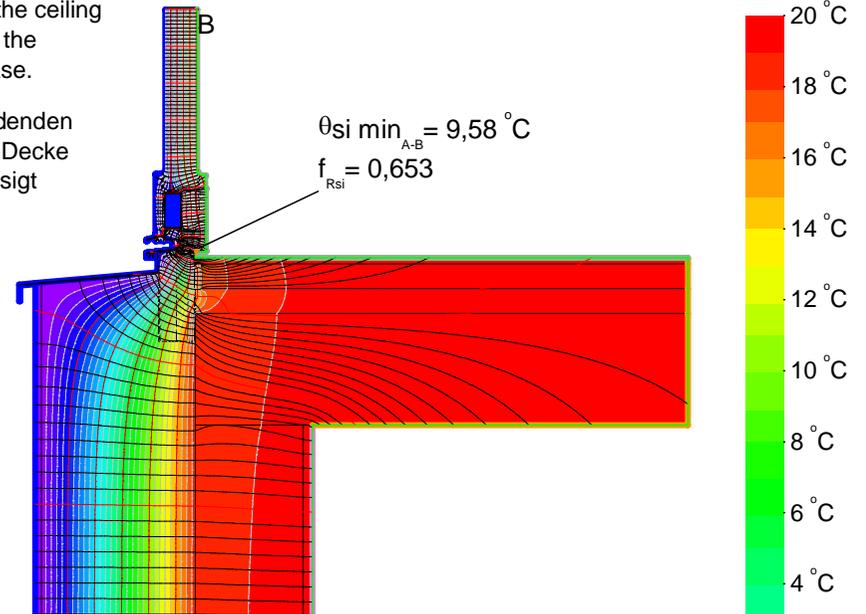
Strictly speaking, according to the PHI methodology, the thermal bridge of the ceiling must be subtracted from the installation bridge. Since the thermal bridge of the ceiling is here about 0 W / (mK), the subtraction can be neglected in this case.

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.



$$\Psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - \frac{\Phi_2}{\Delta T} = \frac{15,317}{30,000} - 0,133 \cdot 1,070 - \frac{9,412}{30,000} = 0,055 \text{ W/(m}\cdot\text{K)}$$

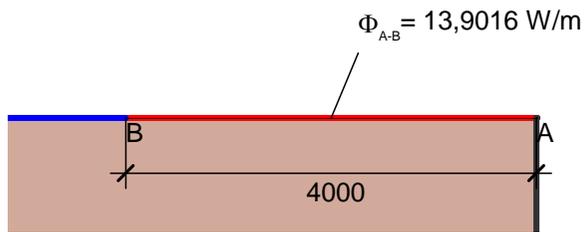
Randbedingung	q[W/m ²]	θ[°C]	R[(m ² ·K)/W]	ε
Adiabatic Adiatat	0,000			
Epsilon 0,05				0,050
Exterior Außen		-10,000	0,040	
Int. flux down Innen abwärts		20,000	0,170	
Interior up. Innen auf.		20,000	0,100	
Interior Innen		20,000	0,130	
Interior, frame, normal		20,000	0,130	
Interior, frame, reduced		20,000	0,200	
e 0,3 Cavity (metal) Hohlraum (Metall)				0,300
e 0,9 Cavity Hohlraum				0,900



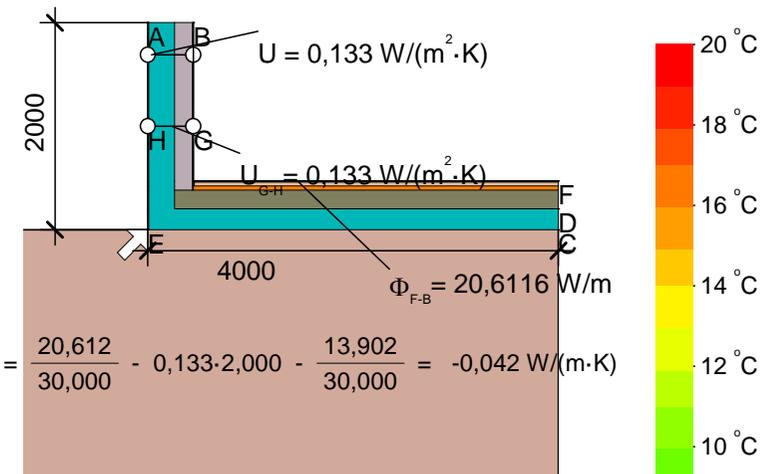
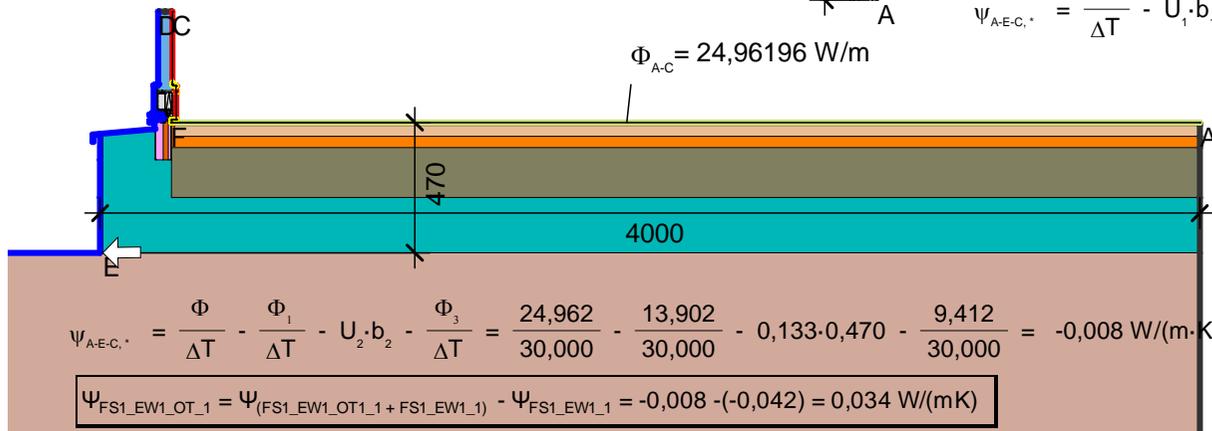
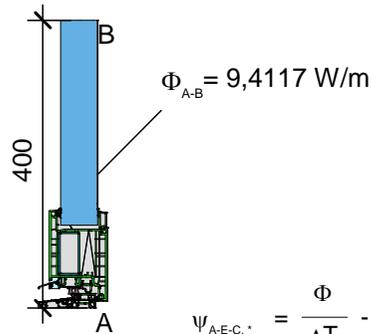
Material	λ[W/(m·K)]	ε
Aluminum Aluminium 10456	160,000	0,900
Artificial stone Kunststein 10456	1,300	0,900
Cement screed Zement-Estrich 4108	1,400	0,900
Concrete, 1% Steel Beton, 1% Stahl 10456	2,300	0,900
EPDM	0,250	0,900
Insulation Wärmedämmung 035	0,035	0,900
Insulation Wärmedämmung 040	0,040	0,900
Interior plaster Gipsputz 10456	0,570	0,900
Luftschicht, ruhend, horizontal, Dicke: 5 mm	0,046	0,900
Organic compound plaster Kunstharzputz 4108-4	0,700	0,900
Panel Maske	0,035	0,900
Polyvinylchloride (PVC)	0,170	0,900
Polyvinylchloride e = 5 %	0,170	0,050
Rodenberg PE XPS 032	0,035	0,900
Rodenberg Porta CELL	0,070	0,900
Sand-lime stone Kalksandstein 1745	1,000	0,900
Silicone Silikon	0,350	0,900
Soft PVC Weich-PVC	0,140	0,900
Steel Stahl e = 30 %	50,000	0,300
Unvent. cavity unbel. Hohlr. *		
slightly vent. cav. leicht bel. Hohlr. *		

* EN ISO 10077-2:2017, 6.4.3



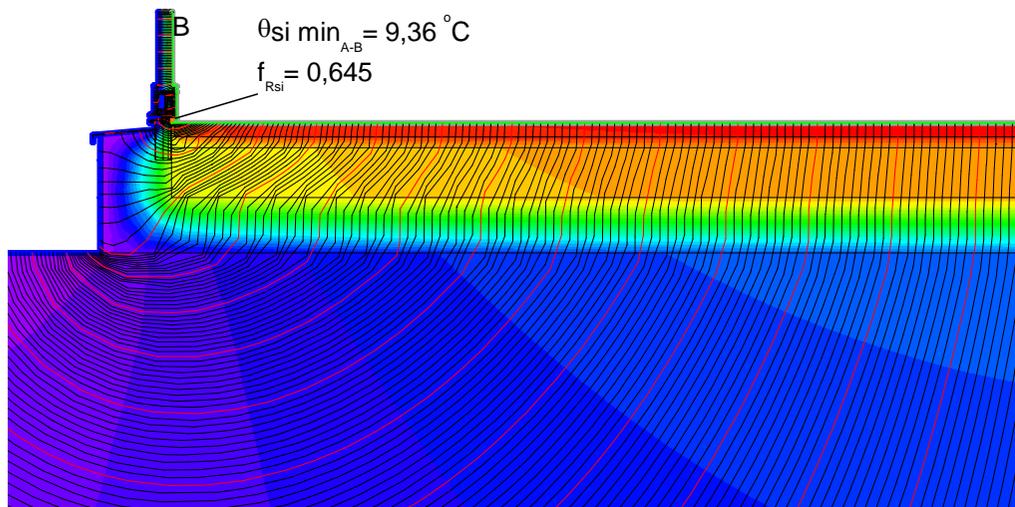
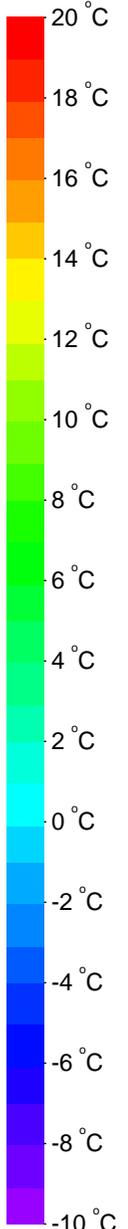


FS1_EW1_OT1 EIFS



Randbedingung q[W/m²] θ[°C] R[(m²·K)/W]

Adiabatic Adiat	0,000	
Exterior Außen	-10,000	0,040
fRsi: Interior Innen	20,000	0,250

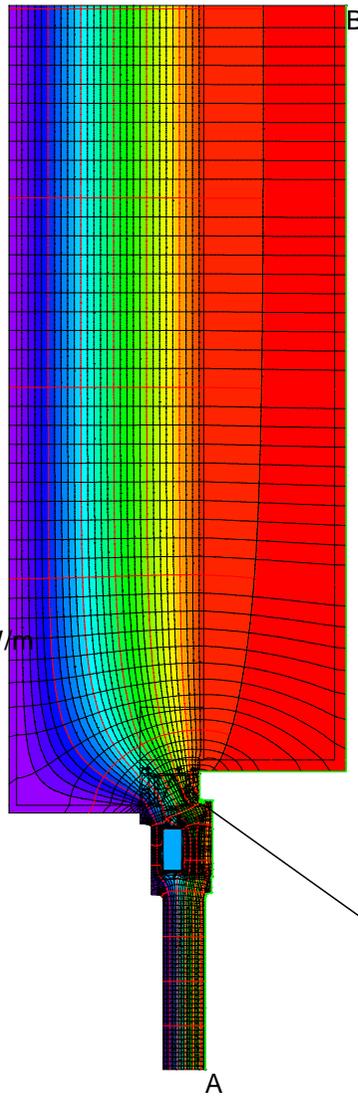
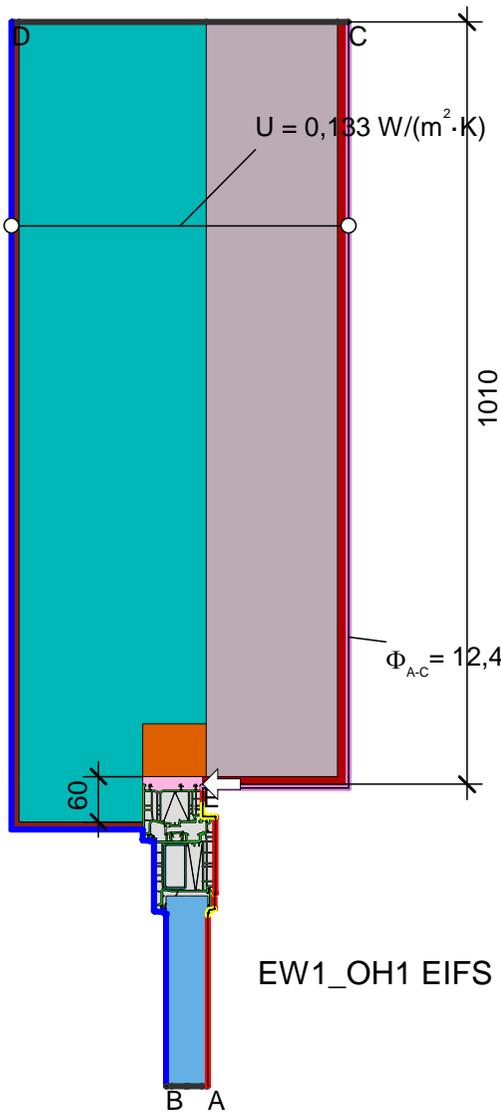


Material

Material	λ[W/(m·K)]	ε
Aluminum Aluminium 10456	160,000	0,900
Artificial stone Kunststein 10456	1,300	0,900
Cement screed Zement-Estrich 4108	1,400	0,900
Concrete, 1% Steel Beton, 1% Stahl 10456	2,300	0,900
EPDM	0,250	0,900
Ground Erdreich	2,000	0,900
Insulation Wärmedämmung 035	0,035	0,900
Insulation Wärmedämmung 040	0,040	0,900
Luftschicht, ruhend, horizontal, Dicke: 5 mm	0,046	0,900
Organic compound plaster Kunstharzputz 4108-4	0,700	0,900
Panel Maske	0,035	0,900
Polyvinylchloride (PVC)	0,170	0,900
Polyvinylchloride e = 5 %	0,170	0,050
Rodenberg PE XPS 032	0,035	0,900
Rodenberg Porta CELL	0,070	0,900
Silicone Silikon	0,350	0,900
Soft PVC Weich-PVC	0,140	0,900
Steel Stahl e = 30 %	50,000	0,300
Unvent. cavity unbel. Hohlr. *		
slightly vent. cav. leicht bel. Hohlr. *		

* EN ISO 10077-2:2017, 6.4.3





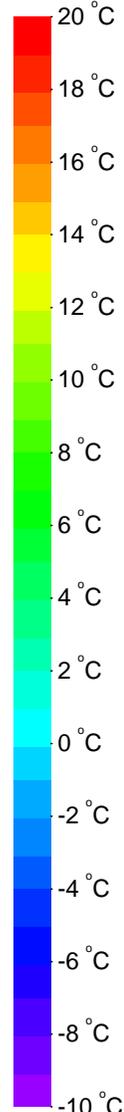
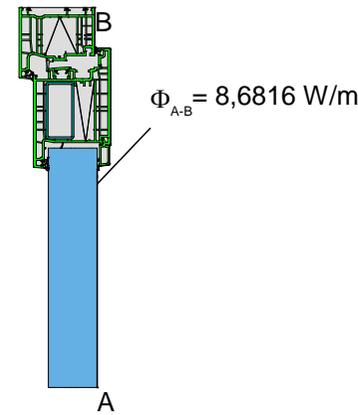
Material

Material	λ [W/(m·K)]	ϵ
Insulation Wärmedämmung 035	0,035	0,900
Interior plaster Gipsputz 10456	0,570	0,900
Organic compound plaster Kunstharzputz 4108-4	0,700	0,900
PU in-situ foam PU-Ortschaum 040	0,040	0,900
Panel Maske	0,035	0,900
Polyvinylchloride (PVC)	0,170	0,900
Polyvinylchloride e = 5 %	0,170	0,050
Rigid EPS-foam incl. screws Fester EPS-Schaum inkl. Schrauben	0,045	0,900
Sand-lime stone Kalksandstein 1745	1,000	0,900
Soft PVC Weich-PVC	0,140	0,900
Steel Stahl e = 30 %	50,000	0,300
Unvent. cavity unbel. Hohlr. *		

* EN ISO 10077-2:2017, 6.4.3

Randbedingung

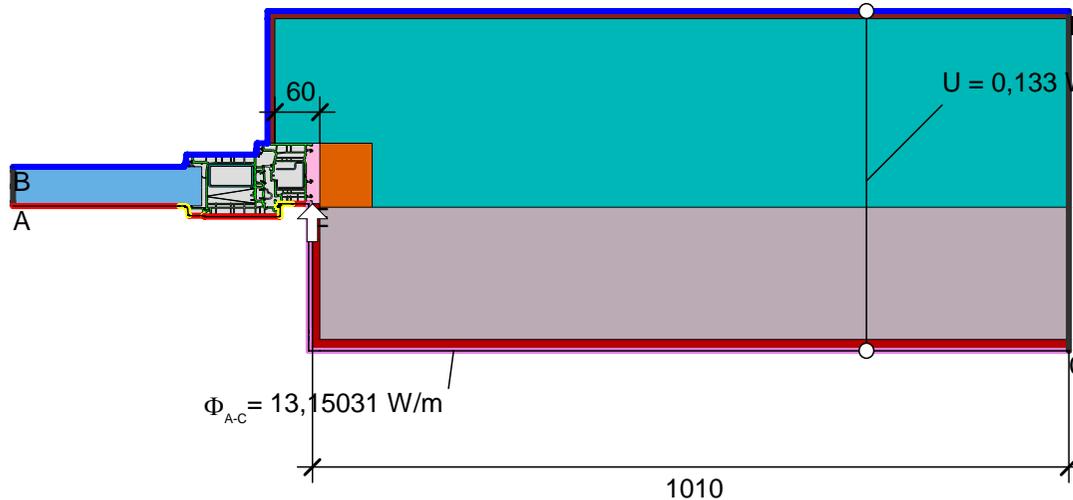
Randbedingung	q [W/m²]	θ [°C]	R [(m²·K)/W]	ϵ
Adiabatic Adiabat	0,000			
Epsilon 0,05				0,050
Exterior Außen	-10,000		0,040	
Interior Innen	20,000		0,130	
Interior, frame, normal	20,000		0,130	
Interior, frame, reduced	20,000		0,200	
e 0,3 Cavity (metal) Hohlraum (Metall)				0,300
e 0,9 Cavity Hohlraum				0,900



$$\psi_{A-E,C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_1}{\Delta T} - U_2 \cdot b_2 = \frac{12,476}{30,000} - \frac{8,682}{30,000} - 0,133 \cdot 1,010 = -0,008 \text{ W/(m·K)}$$



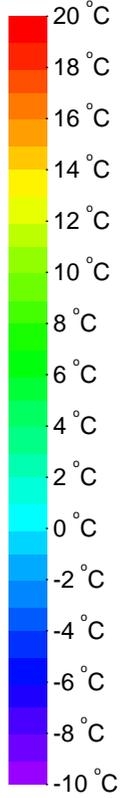
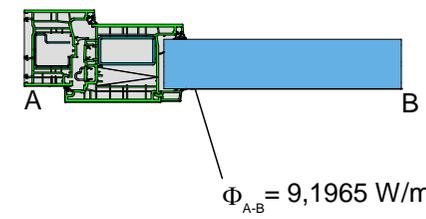
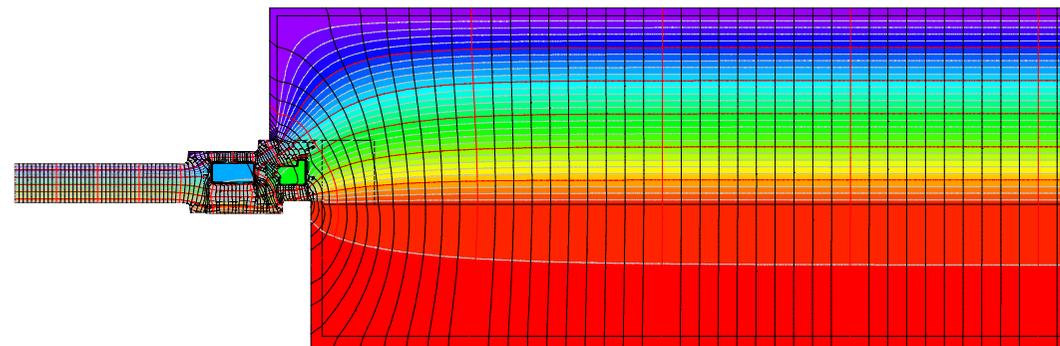
EW1_DJ1 EIFS



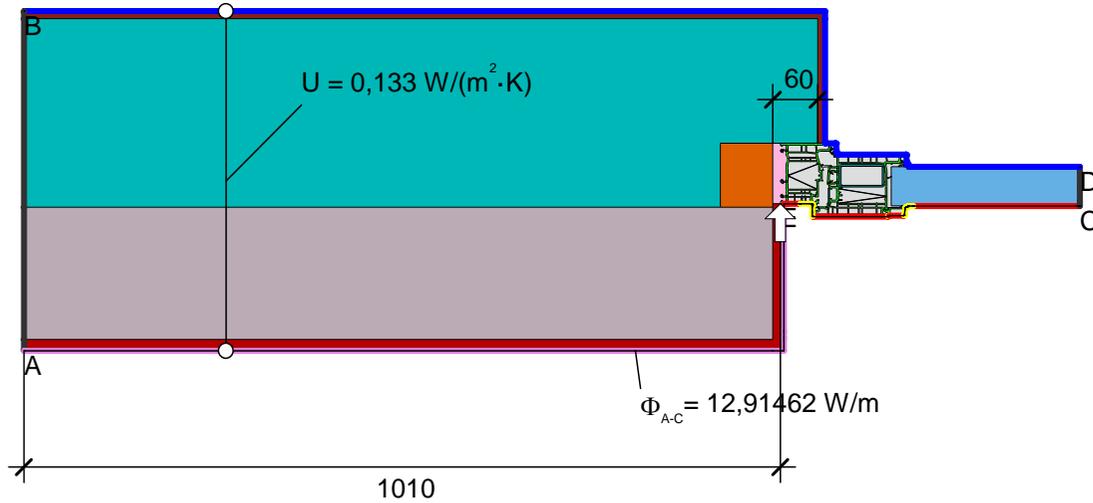
Material	λ [W/(m·K)]	ϵ
Insulation Wärmedämmung 035	0,035	0,900
Interior plaster Gipsputz 10456	0,570	0,900
Organic compound plaster Kunstharzputz 4108-4	0,700	0,900
PU in-situ foam PU-Ortschaum 040	0,040	0,900
Panel Maske	0,035	0,900
Polyvinylchloride (PVC)	0,170	0,900
Polyvinylchloride e = 5 %	0,170	0,050
Rigid EPS-foam incl. screws Fester EPS-Schaum inkl. Schrauben	0,045	0,900
Sand-lime stone Kalksandstein 1745	1,000	0,900
Soft PVC Weich-PVC	0,140	0,900
Steel Stahl e = 30 %	50,000	0,300
Unvent. cavity unbel. Hohlr. *		
* EN ISO 10077-2:2017, 6.4.3		

$$\Psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_1}{\Delta T} - U_2 \cdot b_2 = \frac{13,150}{30,000} - \frac{9,196}{30,000} - 0,133 \cdot 1,010 = -0,002 \text{ W}/(\text{m} \cdot \text{K})$$

Randbedingung	q [W/m ²]	θ [°C]	R [(m ² ·K)/W]	ϵ
Adiabatic Adiabat	0,000			
Epsilon 0,05				0,050
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 0,3 Cavity (metal) Hohlraum (Metall)				0,300
e 0,9 Cavity Hohlraum				0,900

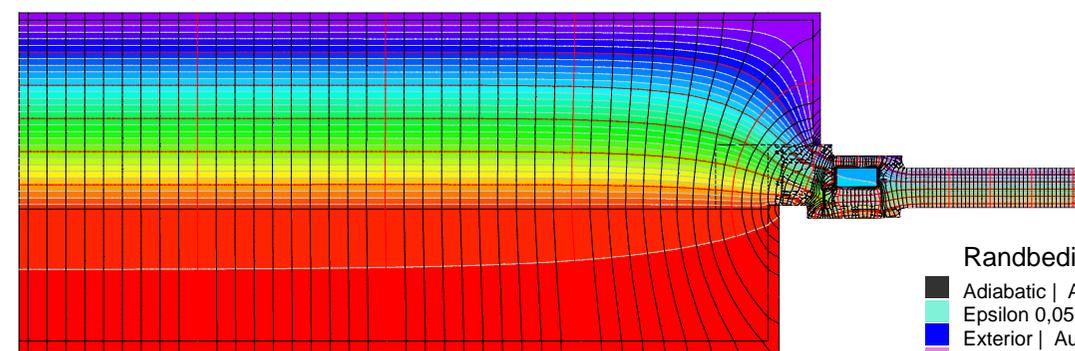
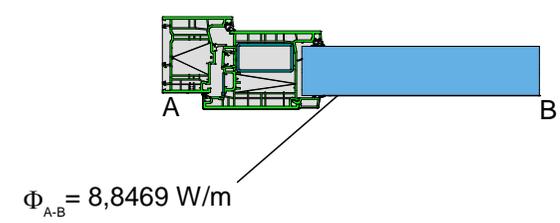


EW1_DL1 EIFS

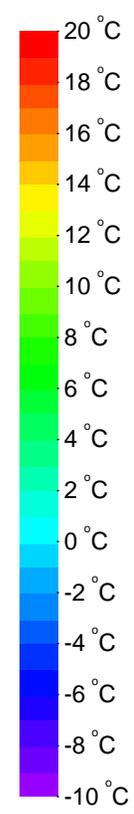


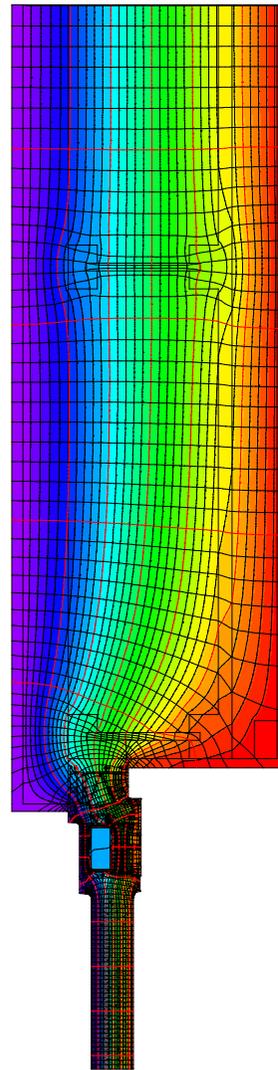
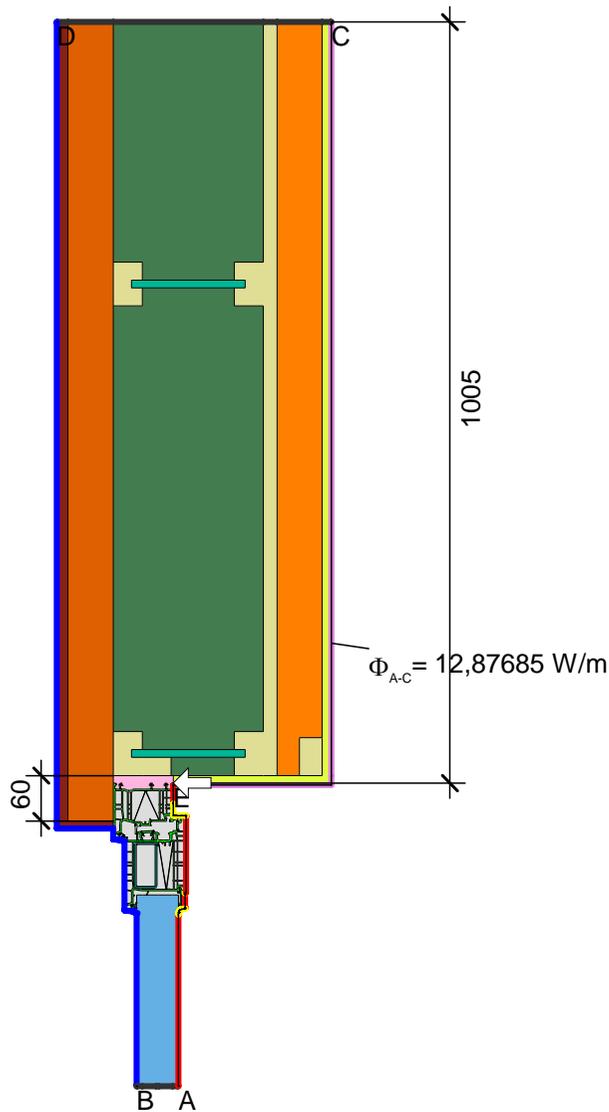
Material	λ[W/(m·K)]	ε
Insulation Wärmedämmung 035	0,035	0,900
Interior plaster Gipsputz 10456	0,570	0,900
Organic compound plaster Kunstharzputz 4108-4	0,700	0,900
PU in-situ foam PU-Ortschaum 040	0,040	0,900
Panel Maske	0,035	0,900
Polyvinylchloride (PVC)	0,170	0,900
Polyvinylchloride e = 5 %	0,170	0,050
Rigid EPS-foam incl. screws Fester EPS-Schaum inkl. Schrauben	0,045	0,900
Sand-lime stone Kalksandstein 1745	1,000	0,900
Soft PVC Weich-PVC	0,140	0,900
Steel Stahl	50,000	0,900
Steel Stahl e = 30 %	50,000	0,300
Unvent. cavity unbel. Hohlr. *		
* EN ISO 10077-2:2017, 6.4.3		

$$\psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - \frac{\Phi_2}{\Delta T} = \frac{12,915}{30,000} - 0,133 \cdot 1,010 - \frac{8,847}{30,000} = 0,001 \text{ W/(m}\cdot\text{K)}$$



Randbedingung	q[W/m ²]	θ[°C]	R[(m ² ·K)/W]	ε
Adiabatic Adiabat	0,000			
Epsilon 0,05				0,050
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 0,3 Cavity (metal) Hohlraum (Metall)				0,300
e 0,9 Cavity Hohlraum				0,900

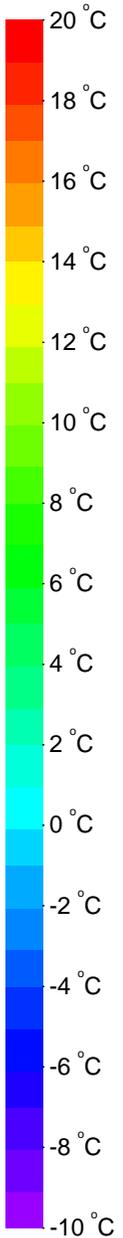
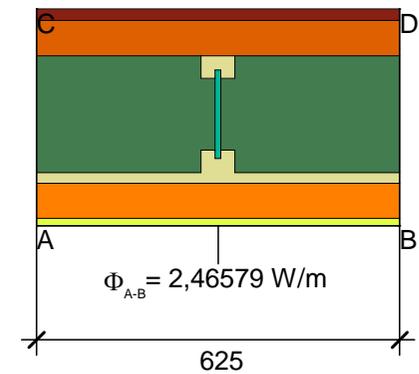
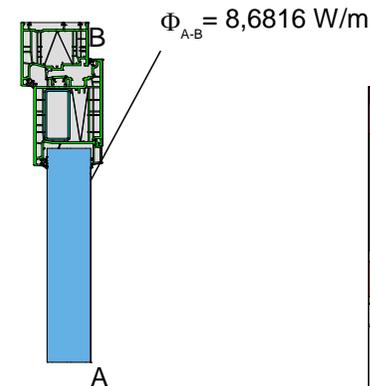




Material	λ [W/(m·K)]	ϵ
Gypsum board Gipskartonplatten 900 kg/m3 10456	0,250	0,900
Insulation 040 90%, timber 13 10%	0,049	0,900
Insulation Dämmstoff 040	0,040	0,900
Insulation Wärmedämmung 040	0,040	0,900
Organic compound plaster Kunstharzputz 4108-4	0,700	0,900
PU in-situ foam PU-Ortschaum 040	0,040	0,900
Panel Maske	0,035	0,900
Polyvinylchloride (PVC)	0,170	0,900
Polyvinylchloride e = 5 %	0,170	0,050
Soft PVC Weich-PVC	0,140	0,900
Softwood flow parallel Weichholz Q parallel	0,290	0,900
Softwood, OSB Weichholz, OSB 10456	0,130	0,900
Steel Stahl e = 30 %	50,000	0,300
Unvent. cavity unbel. Hohlr. *		

* EN ISO 10077-2:2017, 6.4.3

Randbedingung	q [W/m ²]	θ [°C]	R [(m ² ·K)/W]	ϵ
Adiabatic Adiabatt	0,000			
Epsilon 0,05				0,050
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 0,3 Cavity (metal) Hohlraum (Metall)				0,300
e 0,9 Cavity Hohlraum				0,900

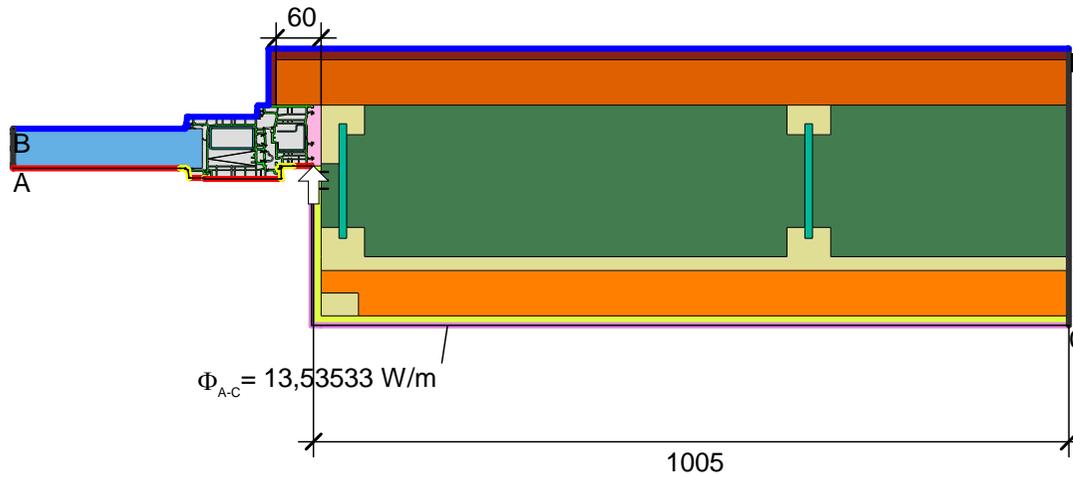


$$\psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_1}{\Delta T} - U_2 \cdot b_2 = \frac{12,877}{30,000} - \frac{8,682}{30,000} - 0,132 \cdot 1,005 = 0,008 \text{ W/(m} \cdot \text{K)}$$

$$U_{\text{eq A-B}} = \frac{\Phi}{\Delta T \cdot b} = \frac{2,466}{30,000 \cdot 0,625} = 0,132 \text{ W/(m}^2 \cdot \text{K)}$$



EW2_DJ1 Timber

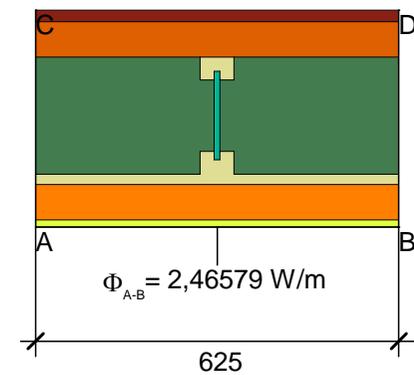
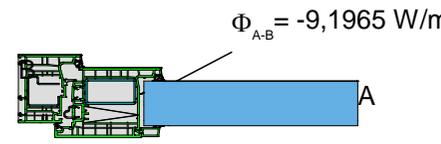
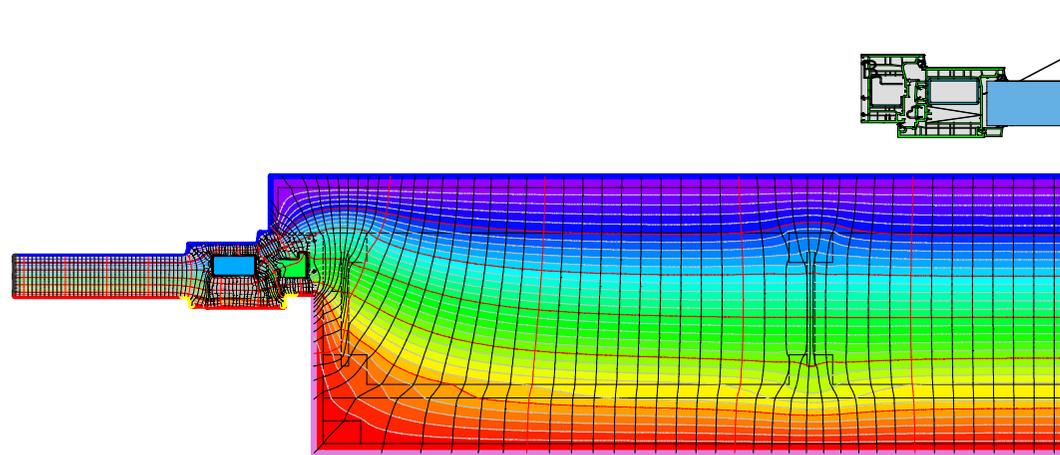


$$\Psi_{A-E,C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_1}{\Delta T} - U_2 \cdot b_2 = \frac{13,535}{30,000} - \frac{9,196}{30,000} - 0,132 \cdot 1,005 = 0,012 \text{ W}/(\text{m} \cdot \text{K})$$

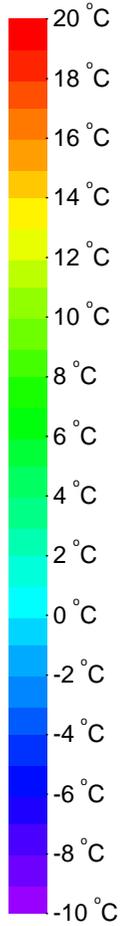
Randbedingung	q[W/m ²]	θ[°C]	R[(m ² ·K)/W]	ε
Adiabatic Adiat	0,000			
Epsilon 0,05				0,050
Exterior Außen		-10,000	0,040	
Interior Innen		20,000	0,130	
Interior, frame, normal		20,000	0,130	
Interior, frame, reduced		20,000	0,200	
e 0,3 Cavity (metal) Hohlraum (Metall)				0,300
e 0,9 Cavity Hohlraum				0,900

Material	λ[W/(m·K)]	ε
Gypsum board Gipskartonplatten 900 kg/m ³ 10456	0,250	0,900
Insulation 040 90%, timber 13 10%	0,049	0,900
Insulation Dämmstoff 040	0,040	0,900
Insulation Wärmedämmung 040	0,040	0,900
Organic compound plaster Kunstharzputz 4108-4	0,700	0,900
PU in-situ foam PU-Ortschaum 040	0,040	0,900
Panel Maske	0,035	0,900
Polyvinylchloride (PVC)	0,170	0,900
Polyvinylchloride e = 5 %	0,170	0,050
Soft PVC Weich-PVC	0,140	0,900
Softwood flow parallel Weichholz Q parallel	0,290	0,900
Softwood, OSB Weichholz, OSB 10456	0,130	0,900
Steel Stahl e = 30 %	50,000	0,300
Unvent. cavity unbel. Hohlr. *		

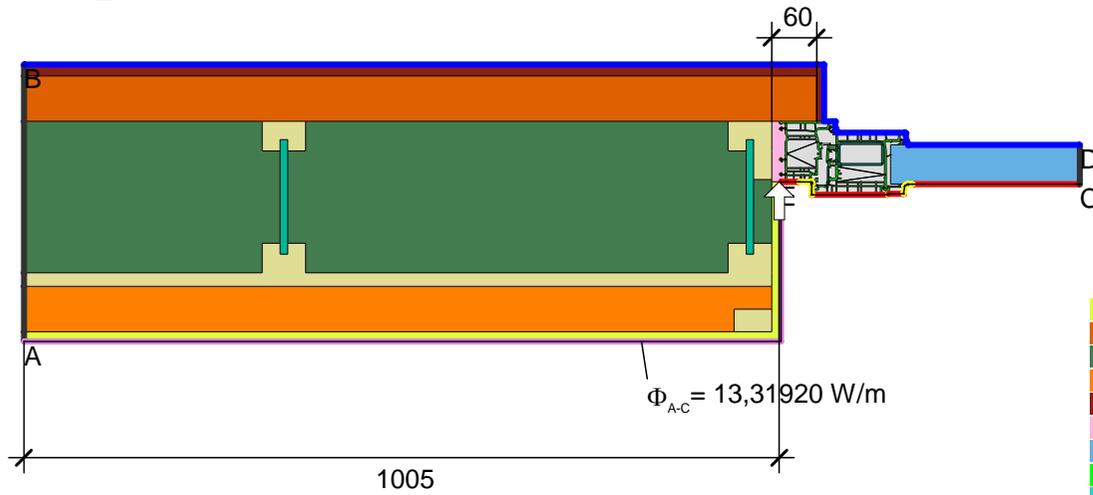
* EN ISO 10077-2:2017, 6.4.3



$$U_{eq A-B} = \frac{\Phi}{\Delta T \cdot b} = \frac{2,466}{30,000 \cdot 0,625} = 0,132 \text{ W}/(\text{m}^2 \cdot \text{K})$$



EW2_DL1 Timber



$\Phi_{A-C} = 13,31920 \text{ W/m}$

$$\psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - \frac{\Phi_2}{\Delta T} = \frac{13,319}{30,000} - 0,132 \cdot 1,005 - \frac{8,847}{30,000} = 0,017 \text{ W}/(\text{m} \cdot \text{K})$$

Randbedingung

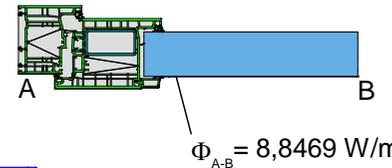
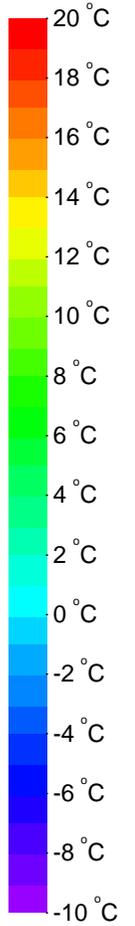
- Adiabatic | Adiat
- Epsilon 0,05
- Exterior | Außen
- Interior | Innen
- Interior, frame, normal
- Interior, frame, reduced
- e 0,3 Cavity (metal) | Hohlraum (Metall)
- e 0,9 Cavity | Hohlraum

$q[\text{W}/\text{m}^2]$	$\theta[\text{C}]$	$R[(\text{m}^2 \cdot \text{K})/\text{W}]$	ϵ
0,000			
	-10,000	0,040	0,050
	20,000	0,130	
	20,000	0,130	
	20,000	0,200	
			0,300
			0,900

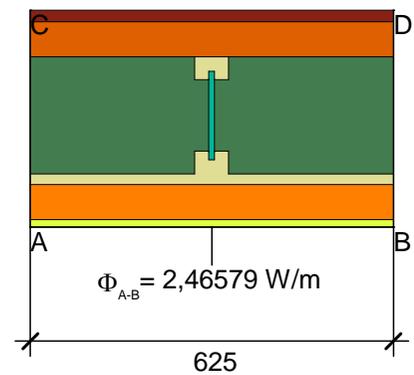
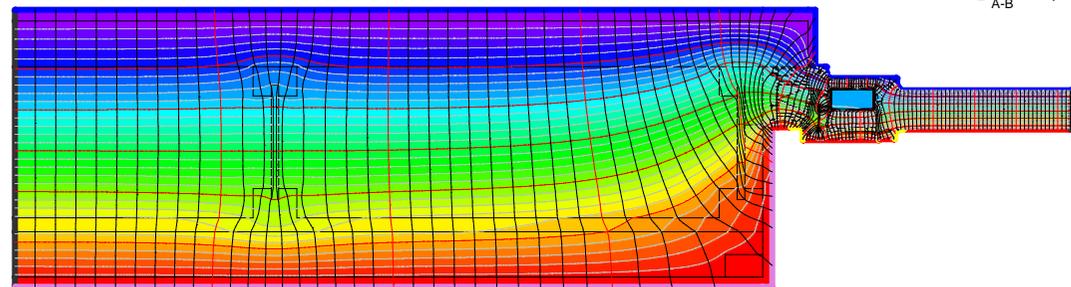
Material

- Gypsum board | Gipskartonplatten 900 kg/m3 10456
 - Insulation 040 90%, timber 13 10%
 - Insulation | Dämmstoff 040
 - Insulation | Wärmedämmung 040
 - Organic compound plaster | Kunstharzputz 4108-4
 - PU in-situ foam | PU-Ortschaum 040
 - Panel | Maske
 - Polyvinylchloride (PVC)
 - Polyvinylchloride e = 5 %
 - Soft PVC | Weich-PVC
 - Softwood flow parallel | Weichholz Q parallel
 - Softwood, OSB | Weichholz, OSB 10456
 - Steel | Stahl
 - Steel | Stahl e = 30 %
 - Unvent. cavity | unbel. Hohlr. *
- * EN ISO 10077-2:2017, 6.4.3

$\lambda[\text{W}/(\text{m} \cdot \text{K})]$	ϵ
0,250	0,900
0,049	0,900
0,040	0,900
0,040	0,900
0,700	0,900
0,040	0,900
0,035	0,900
0,170	0,900
0,170	0,050
0,140	0,900
0,290	0,900
0,130	0,900
50,000	0,900
50,000	0,300



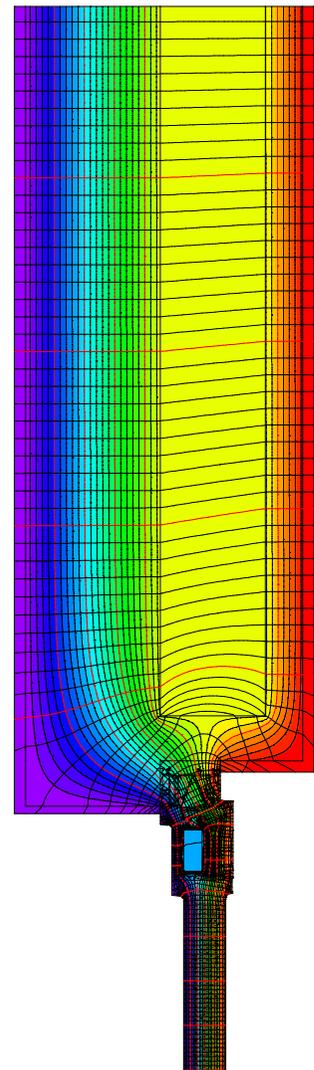
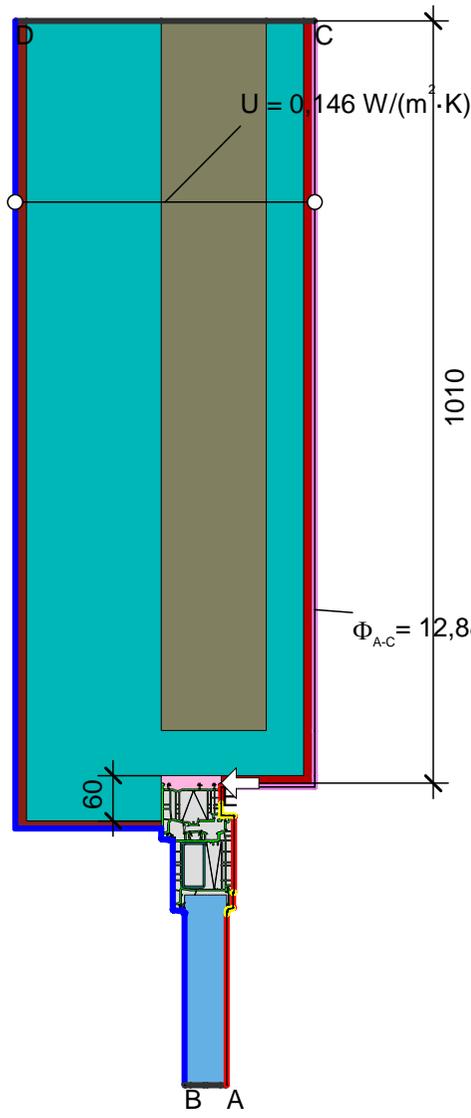
$\Phi_{A-B} = 8,8469 \text{ W/m}$



$\Phi_{A-B} = 2,46579 \text{ W/m}$

$$U_{\text{eq A-B}} = \frac{\Phi}{\Delta T \cdot b} = \frac{2,466}{30,000 \cdot 0,625} = 0,132 \text{ W}/(\text{m}^2 \cdot \text{K})$$





Material

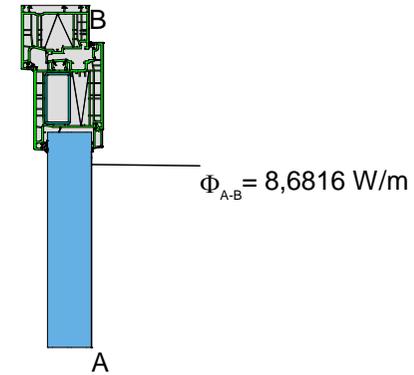
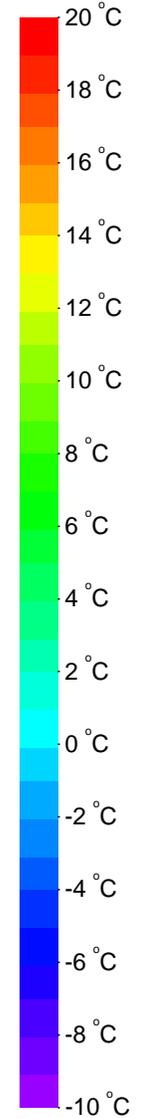
Concrete, 1% Steel Beton, 1% Stahl 10456	2,300	0,900
Insulation Wärmedämmung 035	0,035	0,900
Interior plaster Gipsputz 10456	0,570	0,900
Organic compound plaster Kunstharzputz 4108-4	0,700	0,900
PU in-situ foam PU-Ortschaum 040	0,040	0,900
Panel Maske	0,035	0,900
Polyvinylchloride (PVC)	0,170	0,900
Polyvinylchloride e = 5 %	0,170	0,050
Soft PVC Weich-PVC	0,140	0,900
Steel Stahl e = 30 %	50,000	0,300
Unvent. cavity unbel. Hohlr. *		

λ [W/(m·K)] ϵ

Randbedingung

Adiabatic Adiat	0,000		
Epsilon 0,05			0,050
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 0,3 Cavity (metal) Hohlraum (Metall)			0,300
e 0,9 Cavity Hohlraum			0,900

q [W/m²] θ [°C] R [(m²·K)/W] ϵ

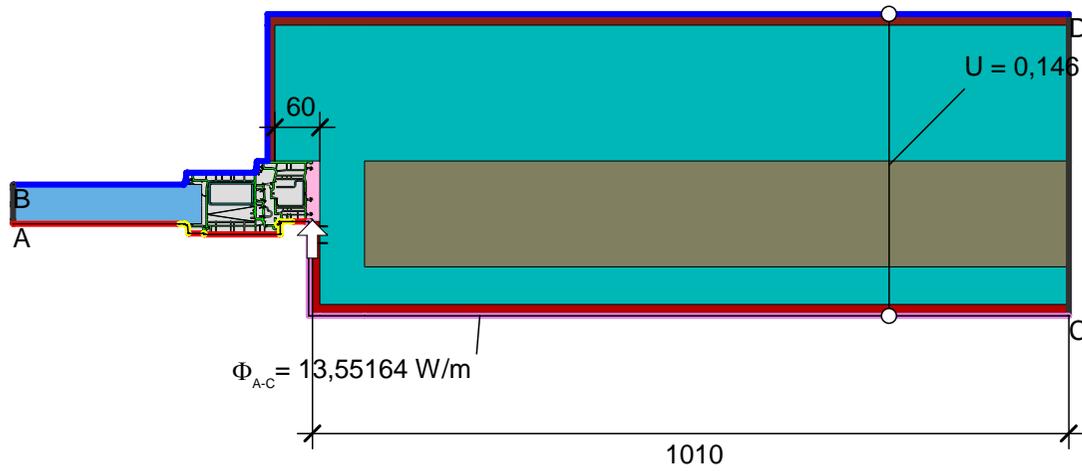


EW3_OH1 BSS

$$\psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_1}{\Delta T} - U_2 \cdot b_2 = \frac{12,887}{30,000} - \frac{8,682}{30,000} - 0,146 \cdot 1,010 = -0,007 \text{ W/(m} \cdot \text{K)}$$



EW3_DJ1 BSS

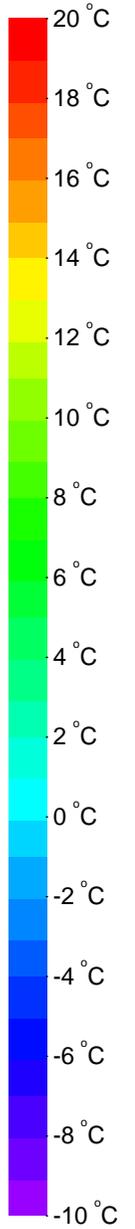
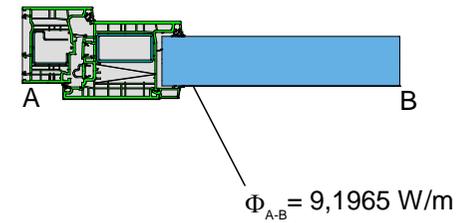
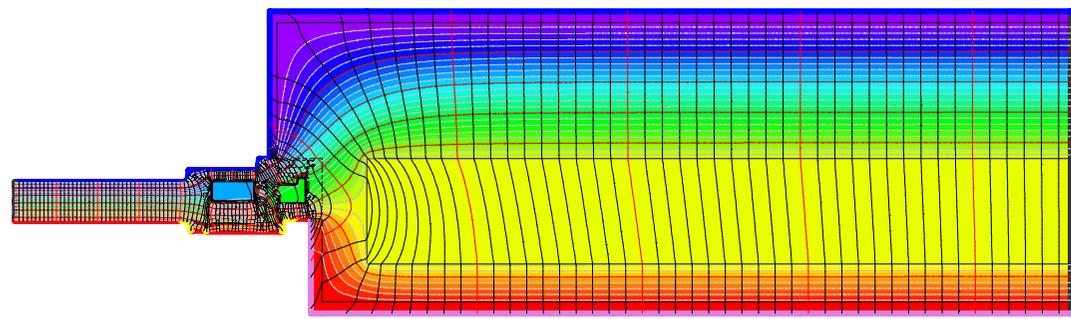


Material	λ [W/(m·K)]	ϵ
Concrete, 1% Steel Beton, 1% Stahl 10456	2,300	0,900
Insulation Wärmedämmung 035	0,035	0,900
Interior plaster Gipsputz 10456	0,570	0,900
Organic compound plaster Kunstharzputz 4108-4	0,700	0,900
PU in-situ foam PU-Ortschaum 040	0,040	0,900
Panel Maske	0,035	0,900
Polyvinylchloride (PVC)	0,170	0,900
Polyvinylchloride e = 5 %	0,170	0,050
Soft PVC Weich-PVC	0,140	0,900
Steel Stahl e = 30 %	50,000	0,300
Unvent. cavity unbel. Hohlr. *		

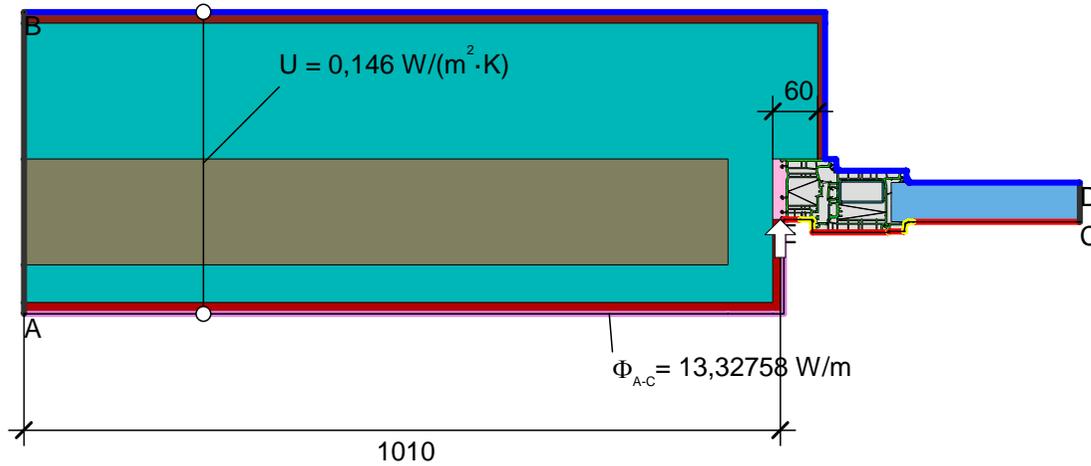
* EN ISO 10077-2:2017, 6.4.3

$$\psi_{A-E-C,*} = \frac{\Phi}{\Delta T} - \frac{\Phi_1}{\Delta T} - U_2 \cdot b_2 = \frac{13,552}{30,000} - \frac{9,196}{30,000} - 0,146 \cdot 1,010 = -0,002 \text{ W/(m} \cdot \text{K)}$$

Randbedingung	q [W/m²]	θ [°C]	R [(m²·K)/W]	ϵ
Adiabatic Adiabatt	0,000			
Epsilon 0,05				0,050
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 0,3 Cavity (metal) Hohlraum (Metall)				0,300
e 0,9 Cavity Hohlraum				0,900



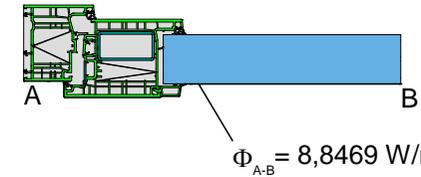
EW3_DL1 BSS



$$\psi_{A-E,C,*} = \frac{\Phi}{\Delta T} - U_1 \cdot b_1 - \frac{\Phi_2}{\Delta T} = \frac{13,328}{30,000} - 0,146 \cdot 1,010 - \frac{8,847}{30,000} = 0,002 \text{ W}/(\text{m} \cdot \text{K})$$

Material

Material	λ[W/(m·K)]	ε
Concrete, 1% Steel Beton, 1% Stahl 10456	2,300	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	0,900
PU in-situ foam PU-Ortschaum 040	0,040	0,900
Panel Maske	0,035	0,900
Polyvinylchloride (PVC)	0,170	0,900
Polyvinylchloride e = 5 %	0,170	0,050
Soft PVC Weich-PVC	0,140	0,900
Steel Stahl	50,000	0,900
Steel Stahl e = 30 %	50,000	0,300
Unvent. cavity unbel. Hohlr. *		
* EN ISO 10077-2:2017, 6.4.3		



Randbedingung	q[W/m ²]	θ[°C]	R[(m ² ·K)/W]	ε
Adiabatic Adiat	0,000			
Epsilon 0,05				0,050
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 0,3 Cavity (metal) Hohlraum (Metall)				0,300
e 0,9 Cavity Hohlraum				0,900

