Briiso giver ingen garanti for beregninger i dette dokument.

254 mm facade with insulated cavity+ 92 mm PIR

Exterior wall
created on 14.2.2025

Thermal protection

U = 0,17 W/(m²K)

EnEV Bestand*: U<0,24 W/(m²K)

excellent insufficient

Moisture proofing

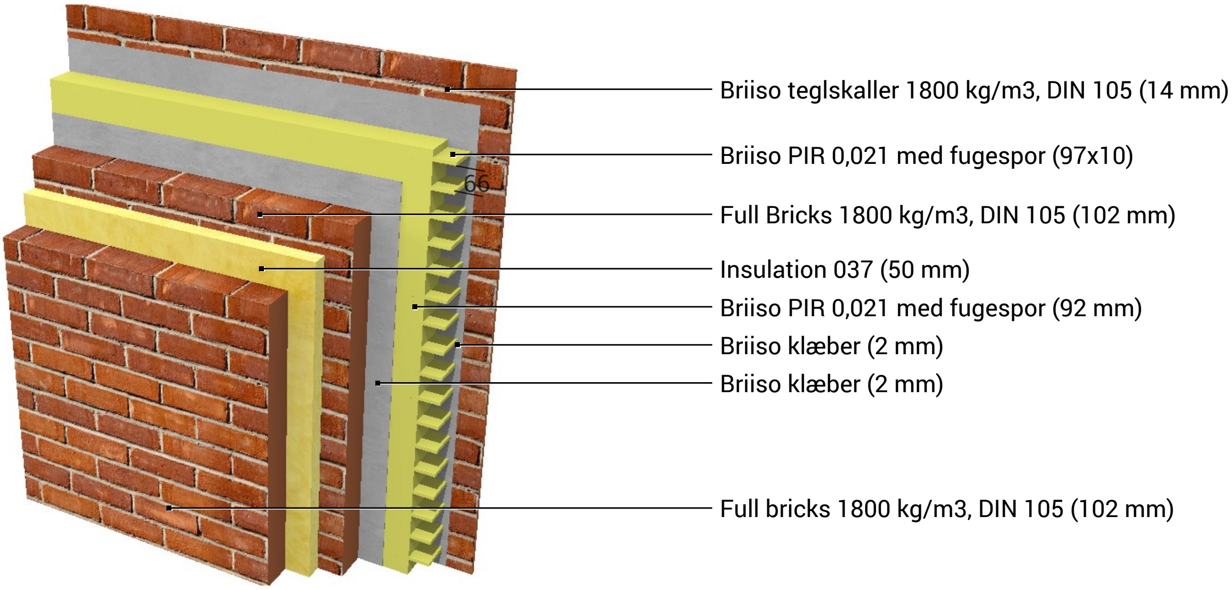
No condensate

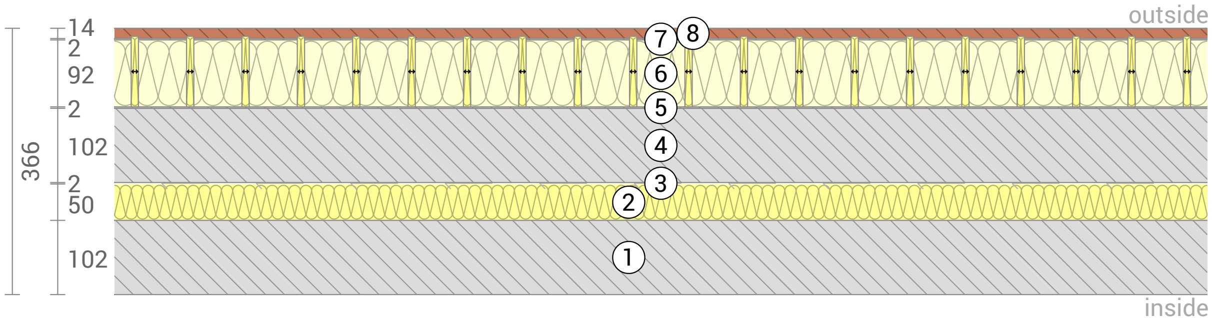
excellent insufficient

Heat protection

Temperature amplitude damping: >100
phase shift: non relevant
Thermal capacity inside: 309 kJ/m²K

excellent insufficient





① Full bricks 1800 kg/m3, DIN 105 (102 mm)
② Insulation 037 (50 mm)
③ Air (2 mm)
④ Full Bricks 1800 kg/m3, DIN 105 (102 mm)
⑤ Briiso klæber (2 mm)
⑥ Briiso PIR 0,021 med fugespor (92 mm)
⑦ Briiso klæber (2 mm)
⑧ Briiso teglskaller 1800 kg/m3, DIN 105 (14 mm)

<-> Layers marked by arrows are perpendicular to the main axis.

Inside air : 20,0°C / 50%
Outside air: -5,0°C / 80%
Surface temperature.: 19,0°C / -4,8°C

sd-value: 0,6 m
Drying reserve: 12399 g/m²a

Thickness: 36,6 cm
Weight: 403 kg/m²
Heat capacity: 406 kJ/m²K

☑ EnEV Bestand ☑ BEG Einzelmaßn. ☑ GEG 2020/24 Bestand ☑ GEG 2023/24 Neubau

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*Comparison of the U-value with den Höchstwerten aus EnEV 2014 Anlage 3 Tabelle 1 (EnEV Bestand); den techn. Mindestanforderungen für BEG Einzelmaßnahmen; den Höchstwerten aus GEG Anlage 7 (GEG 2020-2024 Bestand); 70% des U-Werts der Referenzausführung aus GEG 2023/2024 Anlage 1 (GEG Neubau)

Click here to edit the construction on www.ubakus.de.

254 mm facade with insulated cavity+ 92 mm PIR, U=0,17 W/(m²K)

U-Value calculation according to DIN EN ISO 6946

#	Material	Dicke [cm]	λ [W/mK]	R [m²K/W]
	Thermal contact resistance inside (Rsi)			0,130
1	Full bricks 1800 kg/m3, DIN 105	10,20	0,810	0,126
2	Insulation 037	5,00	0,037	1,351
3	Air	0,20		0,130
4	Full Bricks 1800 kg/m3, DIN 105	10,20	0,810	0,126
5	Briiso klæber	0,20	1,400	0,001
6	Briiso PIR 0,021 med fugespor	9,20	0,021	4,381
	Briiso PIR 0,021 med fugespor (Width: 1 cm)	9,70	0,021	4,619
7	Briiso klæber	0,20	1,400	0,001
8	Briiso teglskaller 1800 kg/m3, DIN 105	1,40	0,810	0,017
	Thermal contact resistance outside (Rse)			0,040

Thermal contact resistances have been taken from DIN 6946 Table 7.
Rsi: heat flow direction horizontally
Rse: heat flow direction horizontally, outside: Direct contact to outside air

DIN 6946 should not be used because the component contains room or outside air.

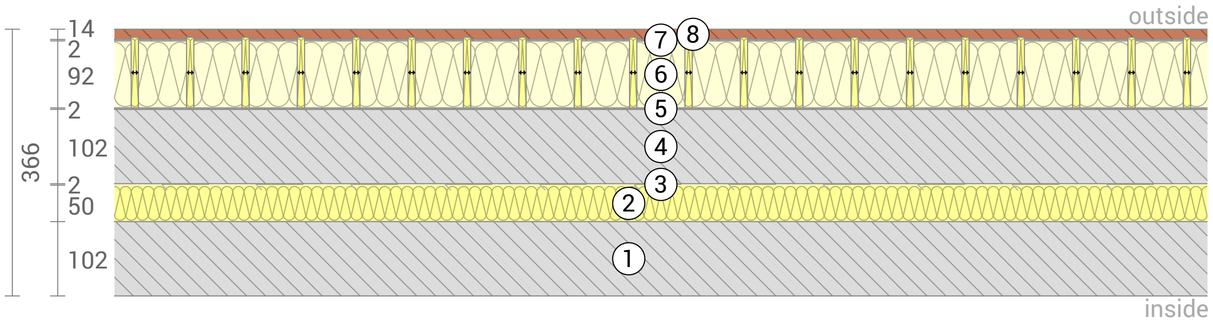
Heat transfer coefficient from finite-elements method U = 0,171 W/(m²K)
numerical uncertainty ~244%

Note: The U value was calculated according to DIN 10211. However, the calculation according to DIN 10211 has not yet been sufficiently tested and may contain errors. The alternative, DIN 6946, must not be used for this component.

Corrections for air gaps / mechanical fastening elements

Anchorage of layer 6.1 (Briiso PIR 0,021 med fugespor) ΔU = 0,012 W/(m²K)

Corrected heat transfer coefficient **U_C = 0,171 W/(m²K)**



254 mm facade with insulated cavity+ 92 mm PIR, U=0,17 W/(m²K)

LCA

Heat loss: 13 kWh/m² per heating season

Amount of heat that escapes through one square meter of this component during the heating period. Please note: Due to internal and solar gains, the heating demand is lower than the heat loss.

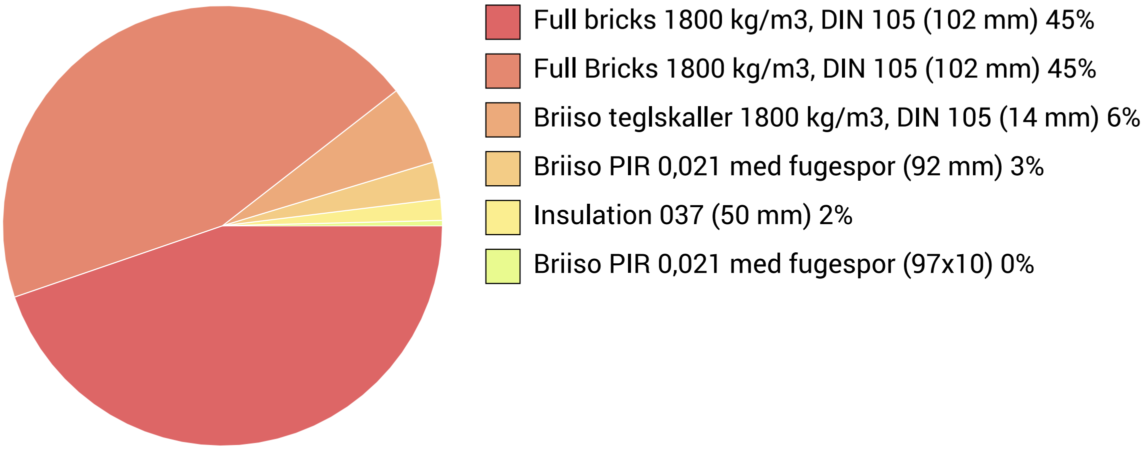
Primary energy (non renewable): 258 kWh/m²

Non-renewable primary energy (= energy from fossil fuels and nuclear energy) that was used to produce the new building materials ("cradle to gate").

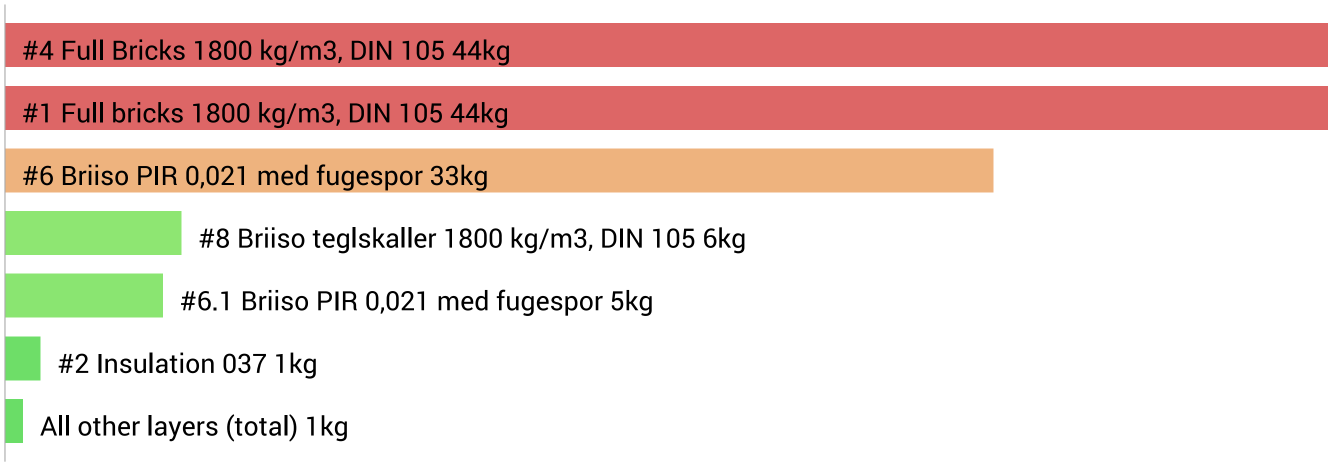
Green house gas potential: 134 kg CO2 Äqv./m²

Quantity of released greenhouse gases in the production of building materials used ("cradle to gate").

Composition of non-renewable primary energy of production:

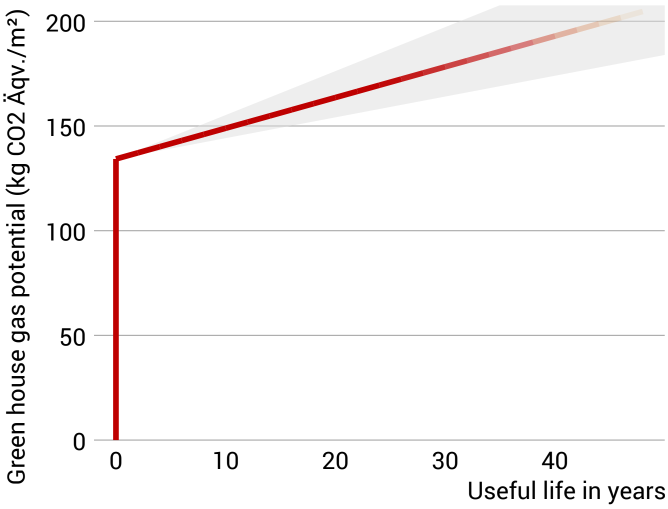


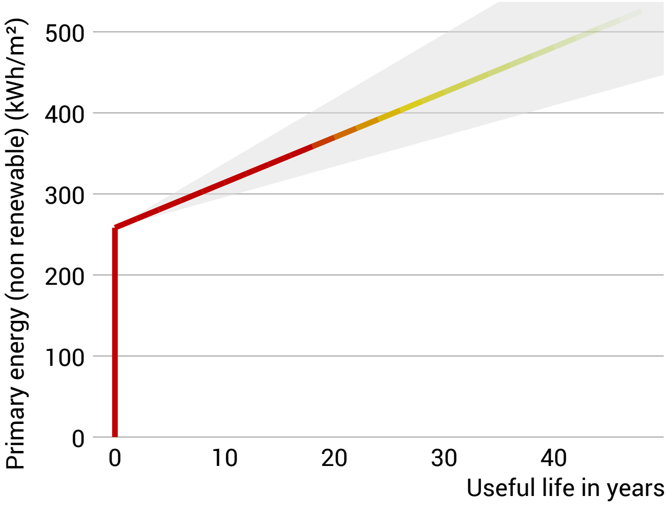
Composition of the greenhouse potential of production:



254 mm facade with insulated cavity+ 92 mm PIR, U=0,17 W/(m²K)

Global warming potential and primary energy for construction and use





The **left figure** shows the global warming potential of the production of the component in the vertical part of the curve. Greenhouse gas emissions (through heating) arising during use of the building are indicated by the upward curve.

The **figure at the bottom left** shows the non-renewable primary energy expenditure for the production of the component in the vertical part of the curve. The primary energy required during use of the building (through heating) is represented by the upward curve.

The longer the component is used unchanged, the more environmentally friendly it is, because the production costs contribute less to the total emissions (indicated by the color of the curve).

Due to unknown solar and internal gains, the heating demand can only be estimated. Accordingly, primary energy consumption and global warming potential during the use phase are only vaguely known. For the estimation it was assumed that solar and internal profits contribute with 4 kWh/a/m² component area. The light gray area indicates the area in which the curve is located with great certainty. For heat generation, a primary energy input of 0,60 kWh per kWh of heat and a global warming potential of 0,16 kg CO2 eqv/m² per kWh of heat was used. Heat source: Heat pump (air-water).

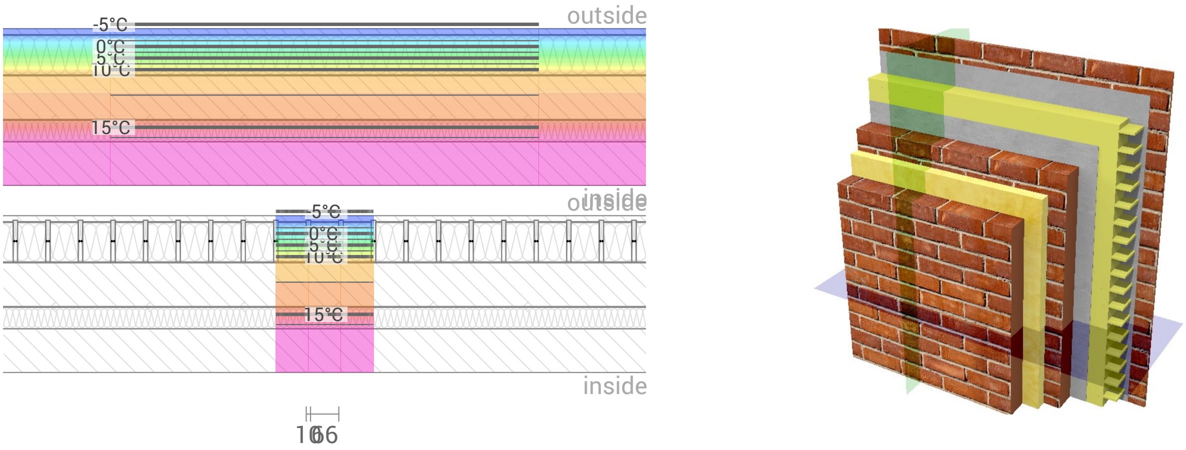
Hints

Calculated for the location DIN V 18599, heating period from Mid of October to End of April. The calculation is based on monthly average temperatures. Source: DIN V 18599-10:2007-02

The climate and energy data on which this calculation is based can, in some cases, show considerable fluctuations and, in individual cases, deviate considerably from the actual value.

254 mm facade with insulated cavity+ 92 mm PIR, U=0,17 W/(m²K)

Temperature profile



Top left: Temperature profile in the blue section (see right illustration). Bottom left: Temperature profile in the green section.

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,250	19,0	20,0	
1	10,2 cm	Full bricks 1800 kg/m3, DIN 105	0,810	0,126	18,5	19,0	183,6
2	5 cm	Insulation 037	0,037	1,351	13,3	18,5	0,8
3	0,2 cm	Air			12,8	13,3	
4	10,2 cm	Full Bricks 1800 kg/m3, DIN 105	0,810	0,126	12,3	12,8	183,6
5	0,2 cm	Briiso klæber	1,400	0,001	12,3	12,3	4,0
6	9,2 cm	Briiso PIR 0,021 med fugespor	0,021	4,381	-4,8	12,3	2,8
	9,7 cm	Briiso PIR 0,021 med fugespor (Width: 1 cm)	0,021	4,619			0,4
7	0,2 cm	Briiso klæber	1,400	0,001	-4,8	-4,8	3,5
8	1,4 cm	Briiso teglskaller 1800 kg/m3, DIN 105	0,810	0,017	-4,8	-4,8	24,5
		Thermal contact resistance*		0,040	-5,0	-4,8	
	36,6 cm	Whole component		5,857			403,2

*Thermal contact resistances according to DIN 4108-3 for moisture protection and temperature profile. The values for the U-value calculation can be found on the page 'U-value calculation'.

Thermal bridges

The U-value includes the following surcharges for air gaps and / or mechanical fasteners in accordance with DIN 6946:

Anchorage of layer 6.1 (Briiso PIR 0,021 med fugespor)	0,012 W/(m²K)

Surface temperature inside (min / average / max):	19,0°C	19,0°C	19,0°C
Surface temperature outside (min / average / max):	-4,8°C	-4,8°C	-4,8°C

Moisture proofing

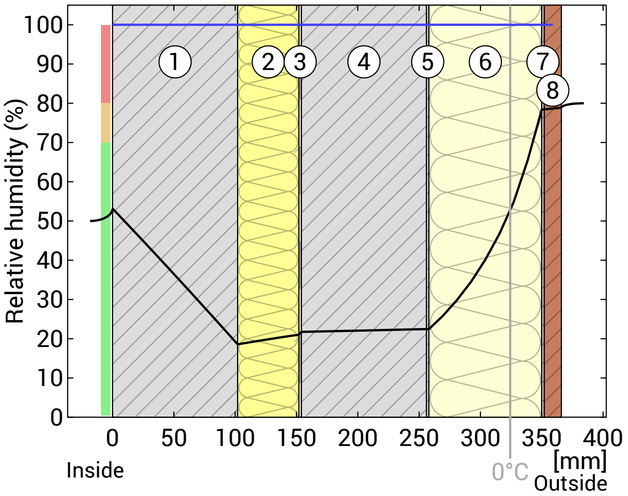
For the calculation of the amount of condensation water, the component was exposed to the following constant climate for 90 days: inside: 20°C und 50% Humidity; outside: -5°C und 80% Humidity. This climate complies with DIN 4108-3.

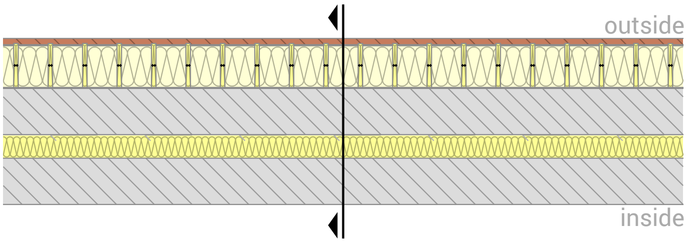
This component is free of condensate under the given climate conditions.

#		Material	sd-value [m]	Condensate [kg/m²]	[Gew.-%]	Weight [kg/m²]
1	10,2 cm	Full bricks 1800 kg/m3, DIN 105	0,51	-		183,6
2	5 cm	Insulation 037	0,05	-		0,8
3	0,2 cm	Air		-		
4	10,2 cm	Full Bricks 1800 kg/m3, DIN 105	0,51	-		183,6
5	0,2 cm	Briiso klæber	0,03	-		4,0
6	9,2 cm	Briiso PIR 0,021 med fugespor	5,52	-		2,8
	9,7 cm	Briiso PIR 0,021 med fugespor (Width: 1 cm)		-		0,4
7	0,2 cm	Briiso klæber	0,07	-		3,5
8	1,4 cm	Briiso teglskaller 1800 kg/m3, DIN 105	0,14	-		24,5
	36,6 cm	Whole component	0,56	0		403,2

Humidity

The temperature of the inside surface is 19,0 °C leading to a relative humidity on the surface of 53%.Mould formation is not expected under these conditions.
The following figure shows the relative humidity inside the component.





① Full bricks 1800 kg/m3, DIN 105 (...
② Insulation 037 (50 mm)
③ Air (2 mm)
④ Full Bricks 1800 kg/m3, DIN 105 (...
⑤ Briiso klæber (2 mm)
⑥ Briiso PIR 0,021 med fugespor (92 mm)
⑦ Briiso klæber (2 mm)
⑧ Briiso teglskaller 1800 kg/m3, DIN...

Layers marked with <-> run parallel to the illustrated cutting plane and were not taken into account in the moisture protection calculation.
Notes: Calculation using the Ubakus 2D-FE method. Convection and the capillarity of the building materials were not considered. The drying time may take longer under unfavorable conditions (shading, damp / cool summers) than calculated here.

Moisture protection in accordance with DIN 4108-3:2018 Appendix A

This moisture proofing is only valid for **non-air-conditioned** residential buildings.

Please note the hints at the end of these moisture proofing calculations.

#		Material	λ [W/mK]	R [m²K/W]	sd [m]	ρ [kg/m³]	T [°C]	ps [Pa]	Σsd [m]
		Thermal contact resistance		0,250			16,46	1873	0
1	10,2 cm	Full bricks 1800 kg/m3, DIN 105	0,810	0,126	0,51	1800	14,68	1670	0,51
2	5 cm	Insulation 037	0,037	1,351	0,05	15	-4,43	421	0,56
		Thermal contact resistance		0,040					

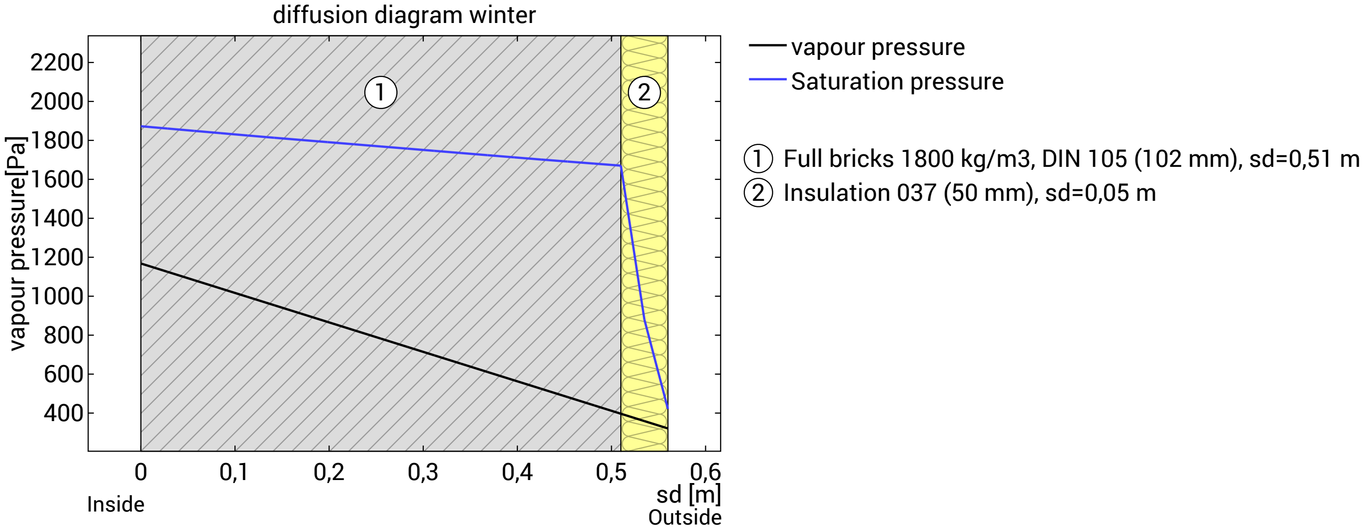
Temperature (T), vapor saturation pressure (ps), and the sum of the sd-values (Σsd) apply to the layer boundary.

Relative air humidity on the surface

The relative humidity on the interior surface is 62%. Requirements for the prevention of building material corrosion depend on material and coating and have not been investigated. ✓

Dew period (winter)

Boundary conditions	
Vapor pressure inside at 20°C and 50% humidity	pi = 1168 Pa
Vapor pressure outside at -5°C and 80% humidity	pe = 321 Pa
Duration of condensation period (90 days)	tc = 7776000 s
Water vapor diffusion coefficient in static air	δ0 = 2.0E-10 kg/(m*s*Pa)
sd-value (Whole component.)	sde = 0,56 m



The section under investigation is free of condensate under the given climate conditions. ✓

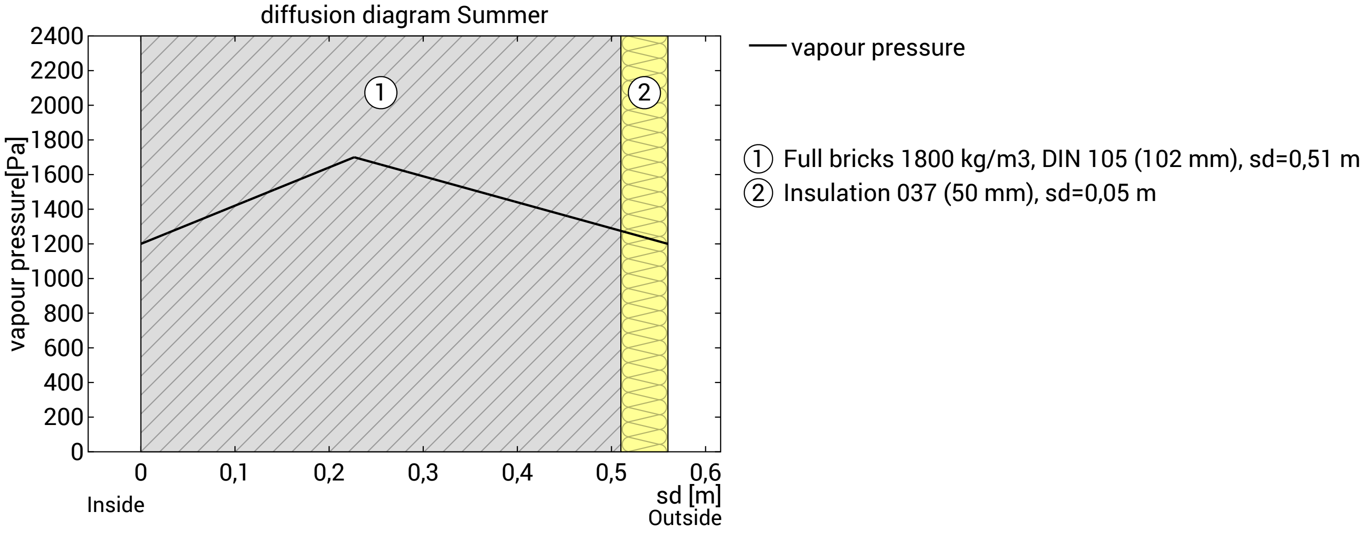
Calculate evaporation potential for the drying reserve in the dew period for the plane with the lowest evaporation potential: sd=0,23 m; ps=1780 pa, within layer Full bricks 1800 kg/m3, DIN 105:

$M_{ev,Tauperiode} = tc \cdot \delta 0 \cdot ((ps-pi)/sd_{ev} + (ps-pe)/(sd_e-sd_{ev}))$ = **11,005 kg/m²**

254 mm facade with insulated cavity+ 92 mm PIR, U=0,17 W/(m²K)

Evaporation period (summer)

Boundary conditions	
Interior vapor pressure	pi = 1200 Pa
Exterior vapor pressure	pe = 1200 Pa
Saturation vapour pressure in the condensation area	ps = 1700 Pa
Length of drying season (90 days)	tev = 7776000 s
sd-values remain unchanged.	



① Full bricks 1800 kg/m3, DIN 105 (102 mm), sd=0,51 m
② Insulation 037 (50 mm), sd=0,05 m

Condensate-free component: The maximum possible evaporation mass for the drying reserve is calculated. Consider the level that has the lowest evaporation potential in the dew period, at sd=0,23 m, within layer Full bricks 1800 kg/m3, DIN 105: Evaporation mass: Mev = δ0 * tev * [(ps-pi)/sd + (ps-pe)/(sde-sd)] = **5,76 kg/m²**

Drying reserve (DIN 68800-2)

Using the block climate from DIN 4108-3:2001 for the calculation of the drying reserve. This climate was used when the limits were set in DIN 68800-2.

#		Material	λ [W/mK]	R [m²K/W]	sd [m]	ρ [kg/m³]	T [°C]	ps [Pa]	∑sd [m]
		Thermal contact resistance		0,130			17,63	2017	0
1	10,2 cm	Full bricks 1800 kg/m3, DIN 105	0,810	0,126	0,51	1800	15,34	1742	0,51
2	5 cm	Insulation 037	0,037	1,351	0,05	15	-9,27	276	0,56
		Thermal contact resistance		0,040					

Temperature (T), vapor saturation pressure (ps), and the sum of the sd-values (Σsd) apply to the layer boundary.

Dew period (winter)

Boundary conditions	
Vapor pressure inside at 20°C and 50% humidity	pi = 1168 Pa
Vapor pressure outside at -10°C and 80% humidity	pe = 208 Pa
Duration of condensation period (60 days)	tc = 5184000 s
Water vapor diffusion coefficient in static air	δ0 = 1.852E-10 kg/(m*s*Pa)
sd-value (Whole component.)	sde = 0,56 m

The section under investigation is free of condensate under the given climate conditions.

Calculate evaporation potential for the drying reserve in the dew period for the plane with the lowest evaporation potential: sd=0,23 m; ps=1891 pa, within layer Full bricks 1800 kg/m3, DIN 105:

Mev,Tauperiode = tc * δ0 * ((ps-pi)/sd_{ev} + (ps-pe)/(sd_e-sd_{ev})) = **7,907 kg/m²**

Click here to edit the construction on www.ubakus.de.

254 mm facade with insulated cavity+ 92 mm PIR, U=0,17 W/(m²K)

Evaporation period (summer)

Boundary conditions	
Interior vapor pressure	pi = 982 Pa
Exterior vapor pressure	pe = 982 Pa
Saturation vapour pressure in the condensation area	ps = 1403 Pa
Length of drying season (90 days)	tev = 7776000 s
sd-values remain unchanged.	

Condensate-free component: The maximum possible evaporation mass for the drying reserve is calculated. Consider the level that has the lowest evaporation potential in the dew period, at sd=0,23 m, within layer Full bricks 1800 kg/m3, DIN 105:
Evaporation mass: Mev = δ0 * tev * [(ps-pi)/sd + (ps-pe)/(sde-sd)] = **4,49 kg/m²**

Dew-water-free component: The evaporation potential of the dew period is also taken into account.
Drying reserve: Mr = (Mev + Mev,Tauperiode) * 1000 = **12399 g/m²/a**
For components which do not contain wood there is no minimum requirement for the drying reserve.

Evaluation according to DIN 4108-3

The component is permissible regarding the moisture protection.

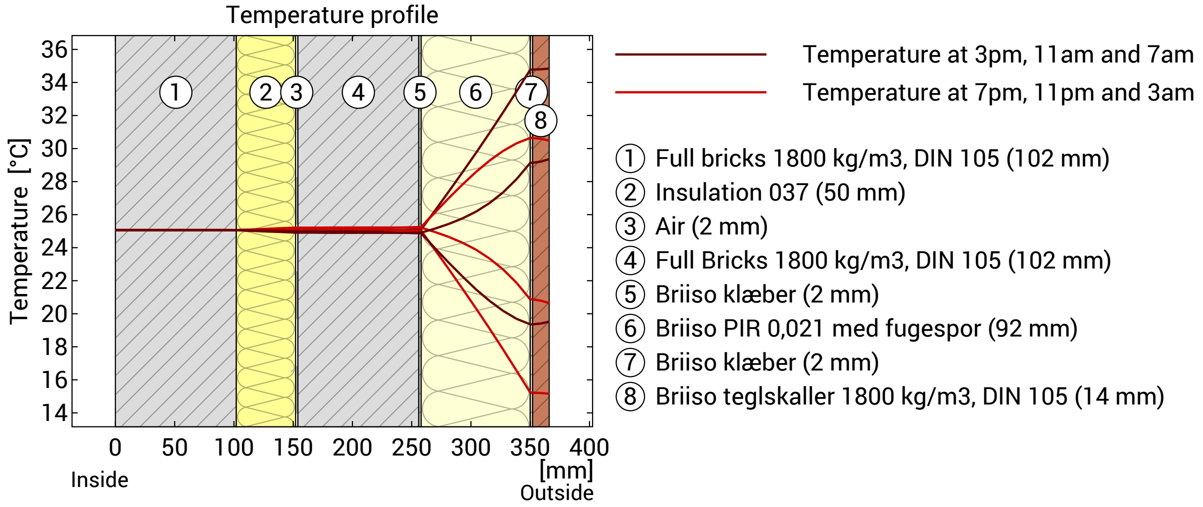
Hints

In the case of inhomogeneous constructions, such as skeleton-, stand- or frame constructions, as well as in wooden beam, rafter or half-timbered constructions or the like, the one-dimensional diffusion calculations are only to be demonstrated for the compartment area. Exceptional cases are special constructions in which, for example, The diffusion-inhibiting layer is also laid section-wise over the outer area. In these exceptional cases, the calculation performed here is invalid.

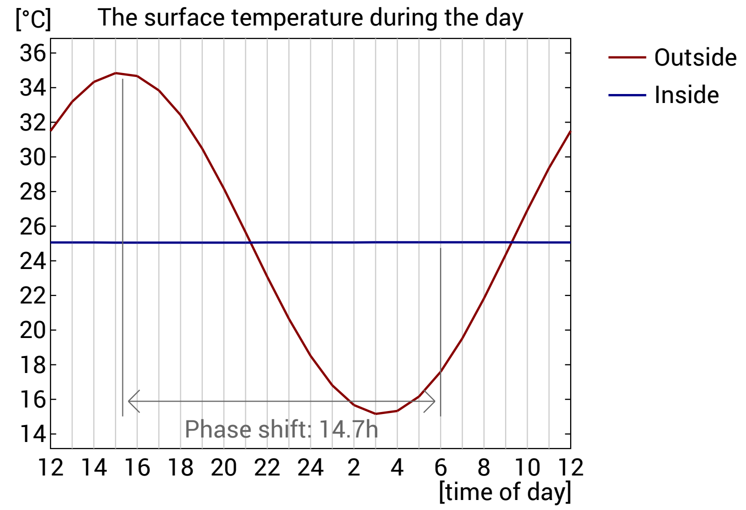
DIN 4108-3 describes in Section 5.3 components for which no moisture proofing is required as there is no risk of condensation water or the method is not suitable for the assessment. It is not possible to assess whether the component under test is underneath.

Heat protection

The following results are properties of the tested component alone and do not make any statement about the heat protection of the entire room:



① Full bricks 1800 kg/m3, DIN 105 (102 mm)
② Insulation 037 (50 mm)
③ Air (2 mm)
④ Full Bricks 1800 kg/m3, DIN 105 (102 mm)
⑤ Briiso klæber (2 mm)
⑥ Briiso PIR 0,021 med fugespor (92 mm)
⑦ Briiso klæber (2 mm)
⑧ Briiso teglskaller 1800 kg/m3, DIN 105 (14 mm)



Top: Temperature profile within the component at different times. From top to bottom, brown lines: at 3 pm, 11 am and 7 am and red lines at 7 pm , 11 pm and 3 am.
Bottom: Temperature on the outer (red) and inner (blue) surface in the course of a day. The arrows indicate the location of the temperature maximum values . The maximum of the inner surface temperature should preferably occur during the second half of the night.

Phase shift*	non relevant	Heat storage capacity (whole component):	406 kJ/m²K
Amplitude attenuation **	>100	Thermal capacity of inner layers:	309 kJ/m²K
TAV ***	0,001		

* The phase shift is the time in hours after which the temperature peak of the afternoon reaches the component interior.
** The amplitude attenuation describes the attenuation of the temperature wave when passing through the component. A value of 10 means that the temperature on the outside varies 10x stronger than on the inside, e.g. outside 15-35 °C, inside 24-26 °C.
*** The temperature amplitude ratio TAV is the reciprocal of the attenuation: TAV = 1 / amplitude attenuation

Note: The heat protection of a room is influenced by several factors, but essentially by the direct solar radiation through windows and the total amount of heat storage capacity (including floor, interior walls and furniture). A single component usually has only a very small influence on the heat protection of the room.

The calculations presented above have been created for a 1-dimensional cross-section of the component.

Hints

DIN 6946 nicht anwendbar

Note: The U value was calculated according to DIN 10211. However, the calculation according to DIN 10211 has not yet been sufficiently tested and may contain errors. The alternative, DIN 6946, must not be used for this component.

All timber layers are rotated

In this construction, all timber layers were rotated by 90°. They therefore run parallel to the cutting plane of the 2D moisture protection calculation and were NOT included in the moisture protection calculation.