240 mm JOIST + 60 mm + vakolattal - 2026 vályoggal

Exterior wall
created on 31.12.2025

Thermal protection

U = 0,11 W/(m²K)

DIN 4108*: R>1,75 m²K/W + R_{si} + R_{se}

excellent insufficient

Moisture proofing

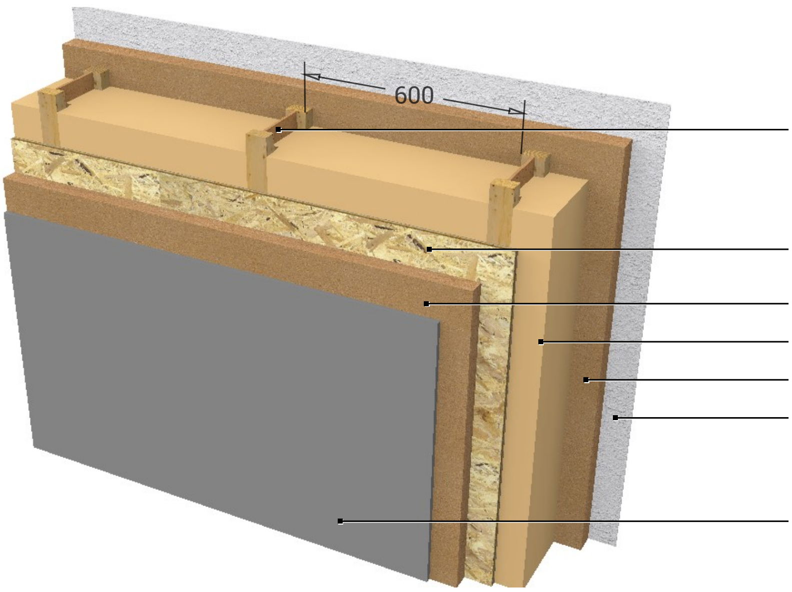
Drying reserve: 2613 g/m²a
No condensate

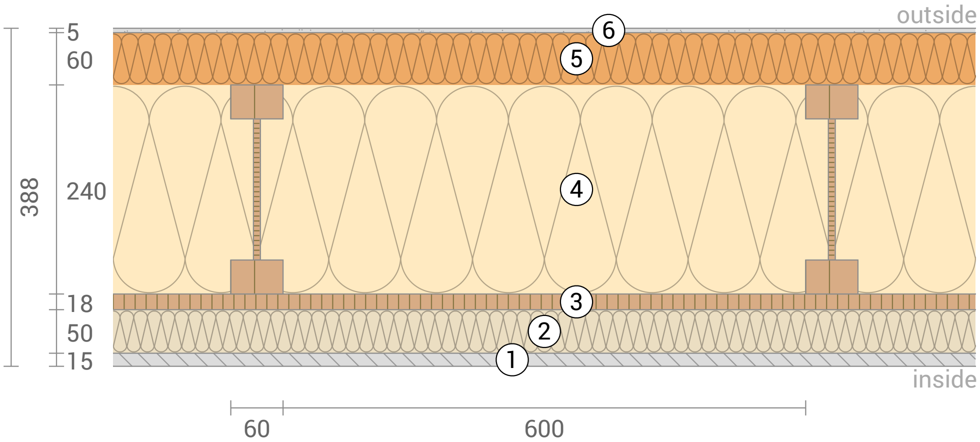
excellent insufficient

Heat protection

Temperature amplitude damping: >100
phase shift: non relevant
Thermal capacity inside: 66 kJ/m²K

excellent insufficient





1. BIOKAY vályogvakolat (15 mm)
2. STEICO install, 140 kg/m3-es kemény farost tábla i (50 mm)
3. elka esb P5 (18 mm)
4. STEICO/NATURHELD fújt farost szigetelés (240 mm)
5. NATURHELD 140-180 kg/m3 kemény farost tábla (60 mm)
6. Mészvakolat (5 mm)

Inside air :	22,0°C / 50%			Thickness:	38,8 cm
Outside air:	-5,0°C / 80%	sd-value:	1,6 m	Weight:	70 kg/m²
Surface temperature.:	21,2°C / -4,9°C			Heat capacity:	109 kJ/m²K

☑ BEG Einzelmaßn. ☑ GEG 2020/24 Bestand ☑ GEG 2023/24 Neubau ☑ DIN 4108

*Comparison of the U-value with 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); den R-Werten aus DIN 4108-2 Tabelle 3

240 mm JOIST + 60 mm + vakolattal - 2026 vályoggal, U=0,11 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	BIOKAY vályogvakolat	1,50	0,635	0,024
2	STEICO install, 140 kg/m3-es kemény farost tábla i	5,00	0,040	1,250
3	elka esb P5	1,80	0,120	0,150
4	STEICO/NATURHELD fújt farost szigetelés	24,00	0,038	6,316
	Hartfasersteg (Width: 0,8 cm)	16,20	0,308	0,526
	Furnierschichtholzgurt (Width: 6 cm)	3,90	0,130	0,300
	Furnierschichtholzgurt (Width: 6 cm)	3,90	0,130	0,300
5	NATURHELD 140-180 kg/m3 kemény farost tábla	6,00	0,041	1,463
6	Mészvakolat	0,50	0,700	0,007
	Thermal contact resistance outside (Rse)			0,040

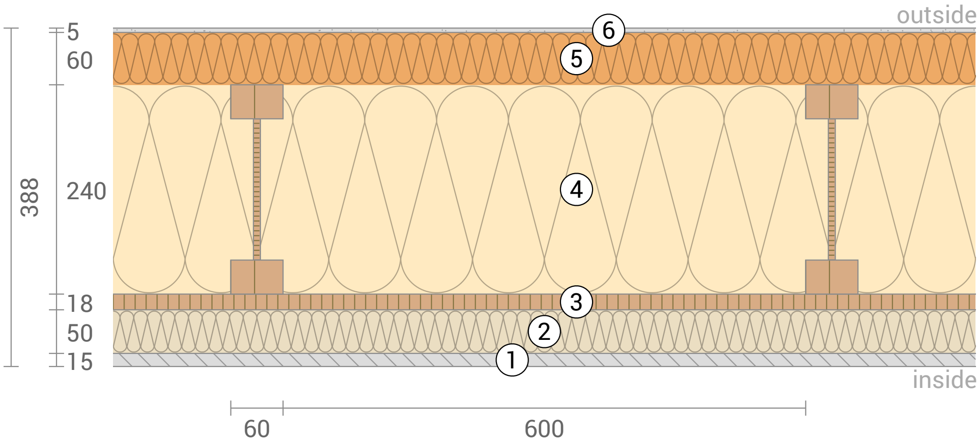
Thermal contact resistances have been taken from DIN 6946 Table 7.
Rsi: heat flow direction horizontally
Rse: heat flow direction horizontally, outside: Direct contact to outside air

Upper limit of thermal resistance $R_{tot;upper}$ = 9,112 m²K/W.
Lower limit of thermal resistance $R_{tot;lower}$ = 8,672 m²K/W.
Check applicability: $R_{tot;upper}$ / $R_{tot;lower}$ = 1,051 (maximum allowed: 1,5)

The procedure may be used.

Thermal resistance R_{tot} = ($R_{tot;upper}$ + $R_{tot;lower}$)/2 = 8,892 m²K/W
Estimated maximum relative uncertainty according to section 6.7.2.5: 2,5%

Heat transfer coefficient U = 1/R_{tot} = **0,11 W/(m²K)**

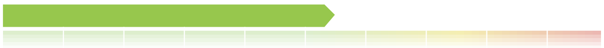


Click here to edit the construction on www.ubakus.de.

240 mm JOIST + 60 mm + vakolattal - 2026 vályoggal, U=0,11 W/(m²K)

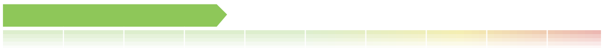
LCA

Heat loss: 11 kWh/m² per heating season



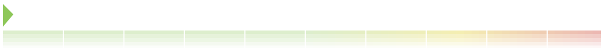
Amount of heat that escapes through one square meter of this component during the heating period. Please note: Due to internal and solar gains, the heating demand is lower than the heat loss.

Primary energy (non renewable): >124 kWh/m²



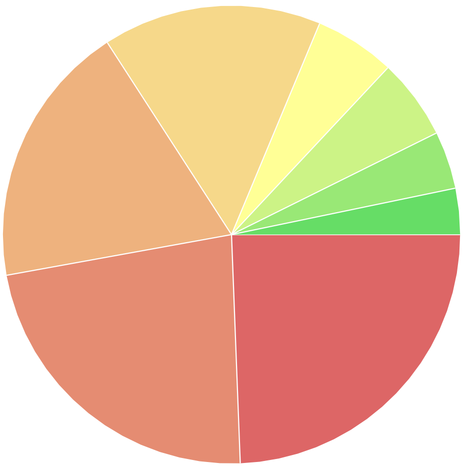
Non-renewable primary energy (= energy from fossil fuels and nuclear energy) that was used to produce the new building materials ("cradle to gate").

Green house gas potential: -43 (?) kg CO2 Äqv./m²



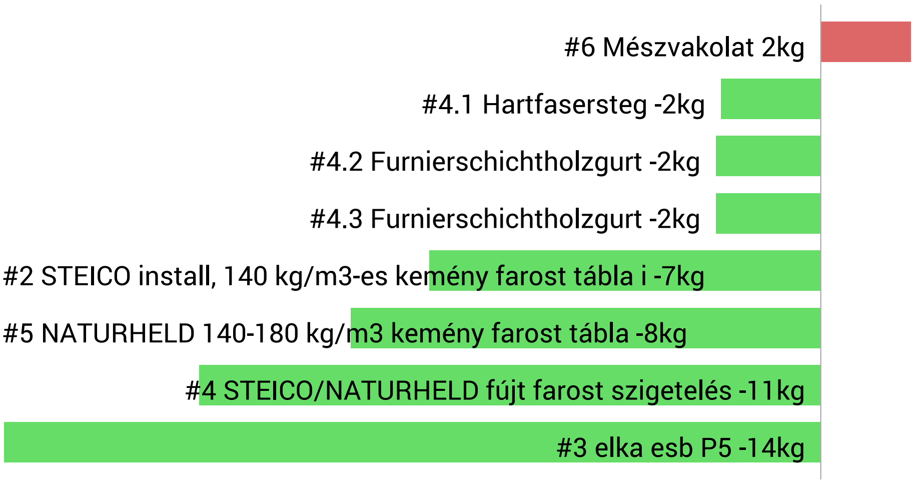
For the production of the building materials used, more greenhouse gases were withdrawn from the atmosphere than emitted.

Composition of non-renewable primary energy of production:



- STEICO/NATURHELD fújt farost szigetelés (240 mm) 24%
- NATURHELD 140-180 kg/m3 kemény farost tábla (60 mm) 23%
- STEICO install, 140 kg/m3-es kemény farost tábla i (50 mm) 19%
- elka esb P5 (18 mm) 15%
- Furnierschichtholzgurt (39x60) 6%
- Furnierschichtholzgurt (39x60) 6%
- Hartfasersteg (162x8) 4%
- Mészvakolat (5 mm) 3%

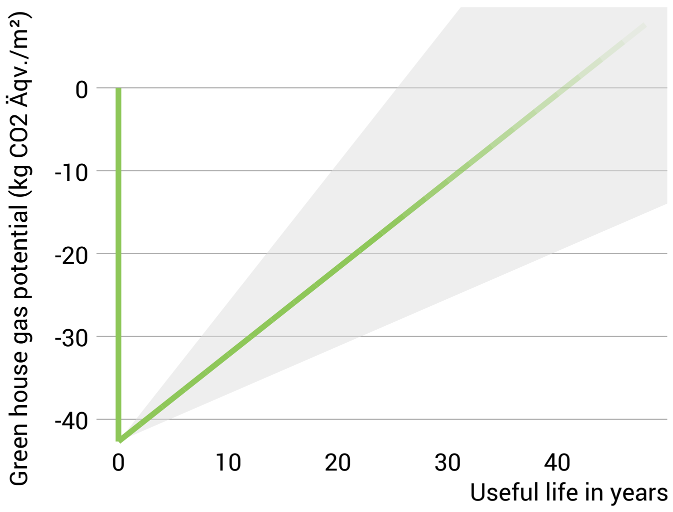
Composition of the greenhouse potential of production:

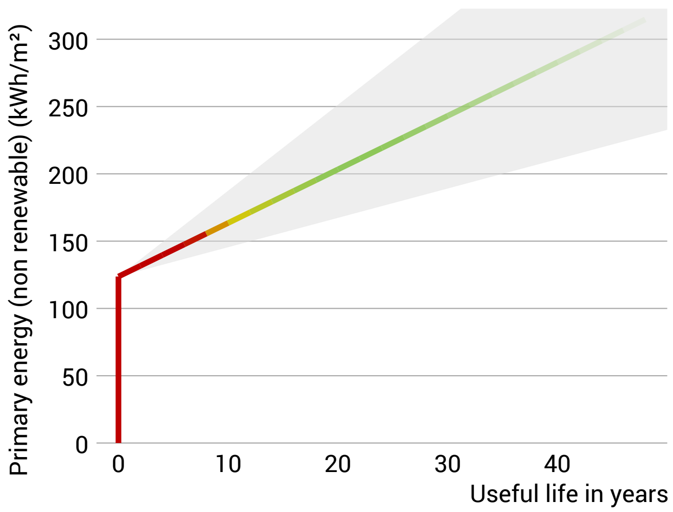


Attention: At least one layer could not be considered because its primary energy content and / or global warming potential is unknown.

240 mm JOIST + 60 mm + vakolattal - 2026 vályoggal, U=0,11 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

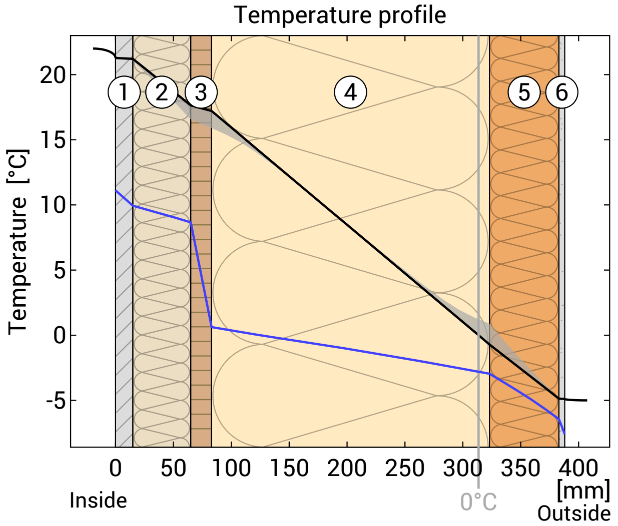
Attention: At least one layer could not be considered because its primary energy content and / or global warming potential is unknown.

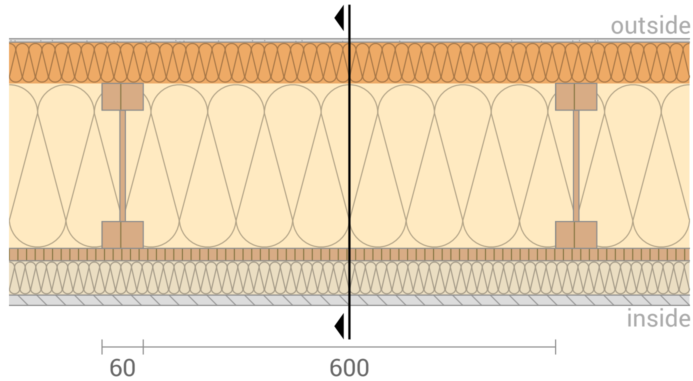
Calculated for the location Graz, heating period from Mid of October to End of April. The calculation is based on monthly average temperatures. Source: www.klimadiagramme.de

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.

240 mm JOIST + 60 mm + vakolattal - 2026 vályoggal, U=0,11 W/(m²K)

Temperature profile





① BIOKAY vályogvakolat (15 mm)
② STEICO install, 140 kg/m3-es kemé...
③ elka esb P5 (18 mm)
④ STEICO/NATURHELD fújt farost szi...
⑤ NATURHELD 140-180 kg/m3 kemé...
⑥ Mészvakolat (5 mm)

Left: Temperature and dew-point temperature at the place marked in the right figure. The dew-point indicates the temperature, at which water vapour condensates. As long as the temperature of the component is everywhere above the dew point, no condensation occurs. If the curves have contact, condensation occurs at the corresponding position.
Right: The component, drawn to scale.

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,250	21,2	22,0	
1	1,5 cm	BIOKAY vályogvakolat	0,635	0,024	21,1	21,3	21,8
2	5 cm	STEICO install, 140 kg/m3-es kemény farost tábla i	0,040	1,250	16,6	21,2	7,0
3	1,8 cm	elka esb P5	0,120	0,150	15,9	17,6	11,2
4	24 cm	STEICO/NATURHELD fújt farost szigetelés	0,038	6,316	-0,7	17,2	9,2
	16,2 cm	Hartfasersteg (Width: 0,8 cm)	0,308	0,526	2,7	14,0	1,8
	3,9 cm	Furnierschichtholzgurt (Width: 6 cm)	0,130	0,300	14,0	16,2	1,8
	3,9 cm	Furnierschichtholzgurt (Width: 6 cm)	0,130	0,300	0,7	2,7	1,8
5	6 cm	NATURHELD 140-180 kg/m3 kemény farost tábla	0,041	1,463	-4,9	0,9	8,4
6	0,5 cm	Mészvakolat	0,700	0,007	-4,9	-4,8	7,0
		Thermal contact resistance*		0,040	-5,0	-4,9	
	38,8 cm	Whole component		8,816			69,9

*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'.

Surface temperature inside (min / average / max):	21,2°C	21,2°C	21,3°C
Surface temperature outside (min / average / max):	-4,9°C	-4,9°C	-4,9°C

240 mm JOIST + 60 mm + vakolattal - 2026 vályoggal, U=0,11 W/(m²K)

Moisture proofing

For the calculation of the amount of condensation water, the component was exposed to the following constant climate for 90 days: inside: 22°C und 50% Humidity; outside: -5°C und 80% Humidity (Climate according to user input).

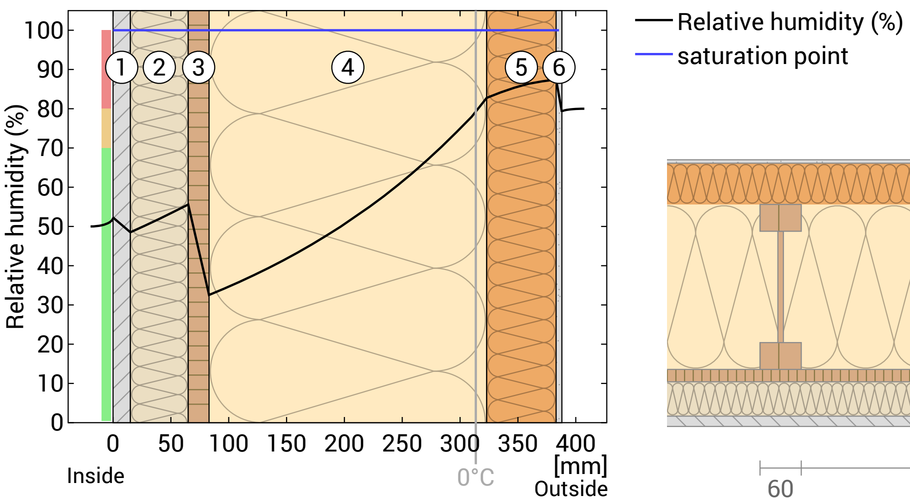
This component is free of condensate under the given climate conditions.

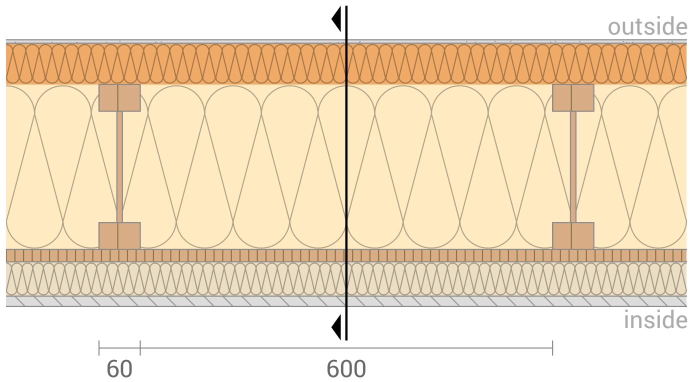
Drying reserve according to Ubakus 2D-FE method: 2613 g/(m²a)
At least required by DIN 68800-2: 100 g/(m²a)

#		Material	sd-value [m]	Condensate [kg/m²]	[Gew.-%]	Weight [kg/m²]
1	1,5 cm	BIOKAY vályogvakolat	0,15	-		21,8
2	5 cm	STEICO install, 140 kg/m3-es kemény farost tábla i	0,15	-		7,0
3	1,8 cm	elka esb P5	0,72	-	-	11,2
4	24 cm	STEICO/NATURHELD fújt farost szigetelés	0,24	-		9,2
	16,2 cm	Hartfasersteg (Width: 0,8 cm)	1,62	-	-	1,8
	3,9 cm	Furnierschichtholzgurt (Width: 6 cm)	0,78	-	-	1,8
	3,9 cm	Furnierschichtholzgurt (Width: 6 cm)	1,95	-	-	1,8
5	6 cm	NATURHELD 140-180 kg/m3 kemény farost tábla	0,18	-		8,4
6	0,5 cm	Mészvakolat	0,05	-		7,0
	38,8 cm	Whole component	1,57	0		69,9

Humidity

The temperature of the inside surface is 21,2 °C leading to a relative humidity on the surface of 52%.Mould formation is not expected under these conditions.
The following figure shows the relative humidity inside the component.





① BIOKAY vályogvakolat (15 mm) ② STEICO install, 140 kg/m3-es kemé... ③ elka esb P5 (18 mm) ④ STEICO/NATURHELD fújt farost szi... ⑤ NATURHELD 140-180 kg/m3 kemé... ⑥ Mészvakolat (5 mm)

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.

240 mm JOIST + 60 mm + vakolattal - 2026 vályoggal, U=0,11 W/(m²K)

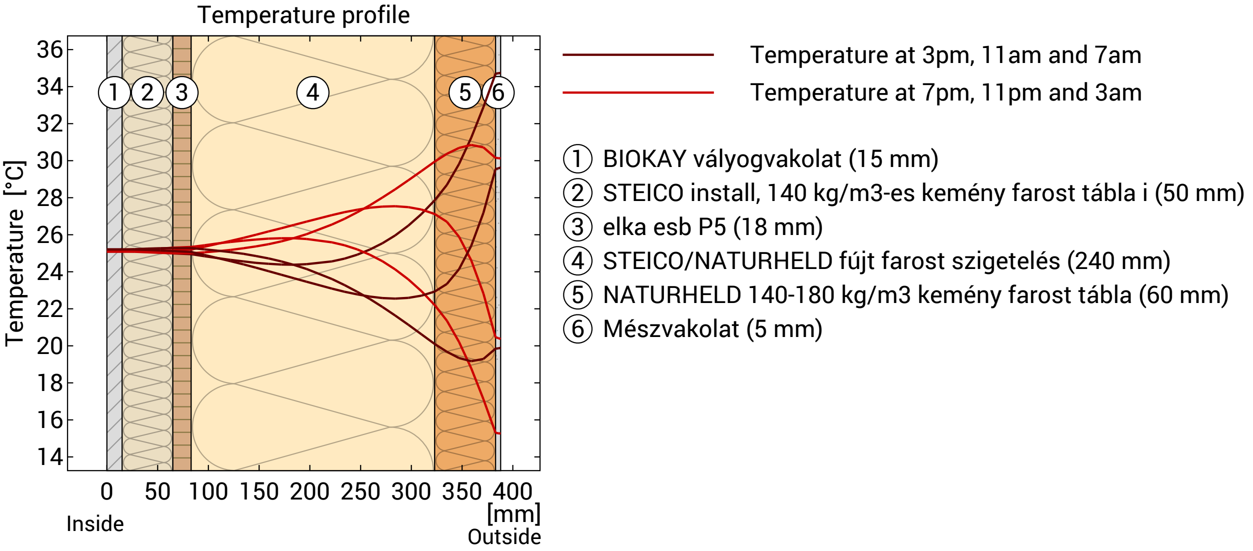
Moisture protection in accordance with DIN 4108-3:2024 Appendix A

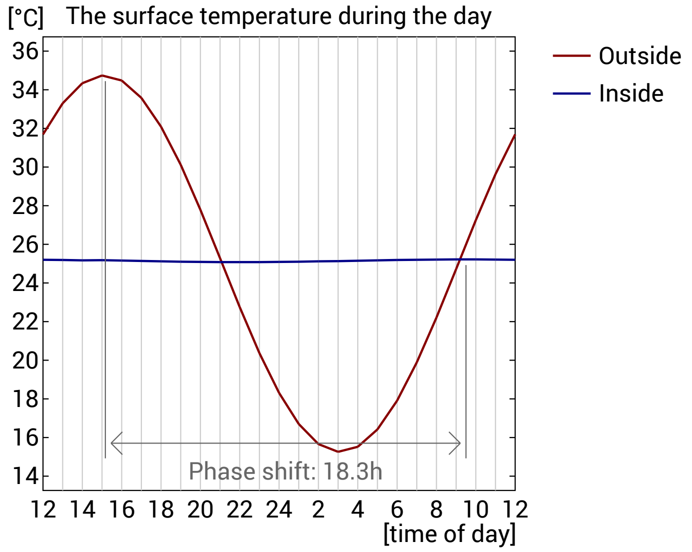
The temperatures and / or humidities you specify are not in accordance with DIN 4108-3. The following values are given by DIN 4108-3: 20°C / 50% humidity inside and -5°C / 80% humidity outside. Change the values in the input form to enable the calculation according to DIN 4108-3.

240 mm JOIST + 60 mm + vakolattal - 2026 vályoggal, U=0,11 W/(m²K)

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:





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):	109 kJ/m²K
Amplitude attenuation **	>100	Thermal capacity of inner layers:	66 kJ/m²K
TAV ***	0,007		

* 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.

240 mm JOIST + 60 mm + vakolattal - 2026 vályoggal, U=0,11 W/(m²K)

Hints

Mindestwärmeschutz nach DIN 4108-2

Der Höchstwert U < 0.52 W/m²K gilt nur für homogene Bauteile ohne Abdichtungen. Daneben gilt gemäß Absatz 5.1.3 die folgende Anforderung:

"Bei thermisch inhomogenen Bauteilen, wie sie beispielsweise bei Skelett-, Rahmen- oder Holzständerbauweisen, aber auch bei Fassaden als Pfosten-Riegel-Konstruktion vorkommen, ist im Bereich des Gefachs ein Wärmedurchlasswiderstand $R_G \geq$ 1,75 m²K/W einzuhalten. Zusätzlich gilt für das gesamte Bauteil im Mittel ein Anforderungswert von $R_m \geq$ 1,0 m²K/W."

Für Umkehrdächer und Perimeterdämmungen beschreibt Absatz 5.2.2 zusätzliche Anforderungen.

Die Einhaltung dieser Anforderungen (falls zutreffend) ist vom verantwortlichen Planer zu prüfen.