Wohnhauses mit 4 celing

Ceiling
created on 2.10.2024

Thermal protection

U = 0,26 W/(m²K)

Heated on both sides: No requirement*

excellent — insufficient

Moisture proofing

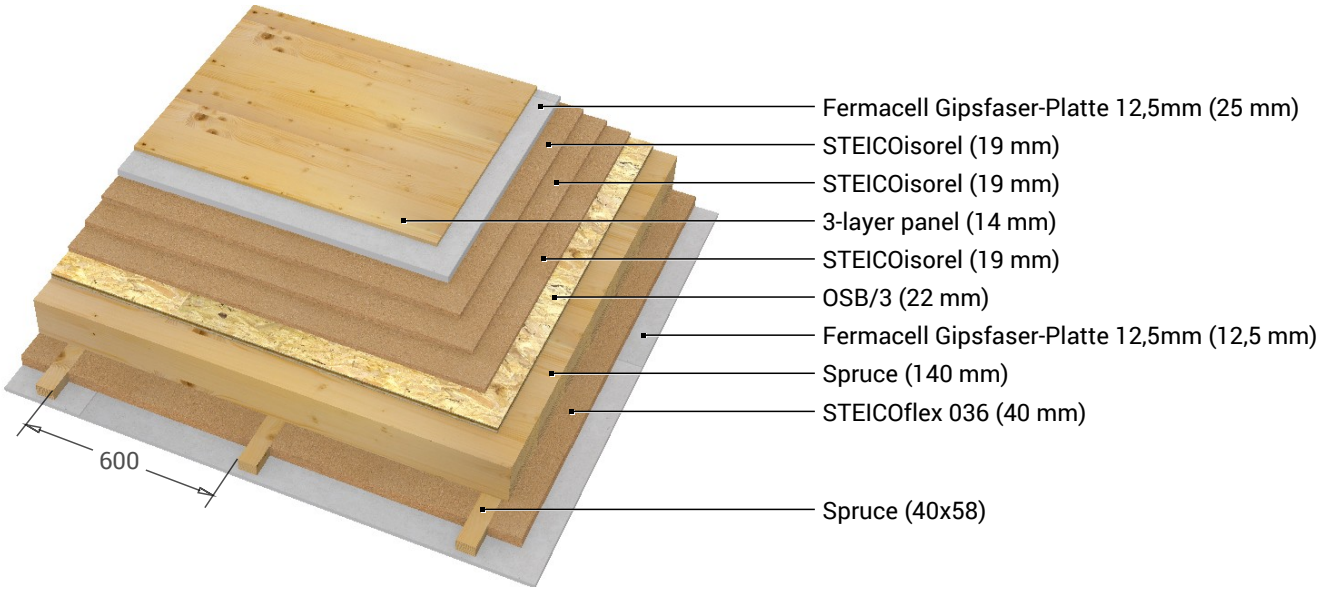
Drying reserve: 236 g/m²a
No condensate

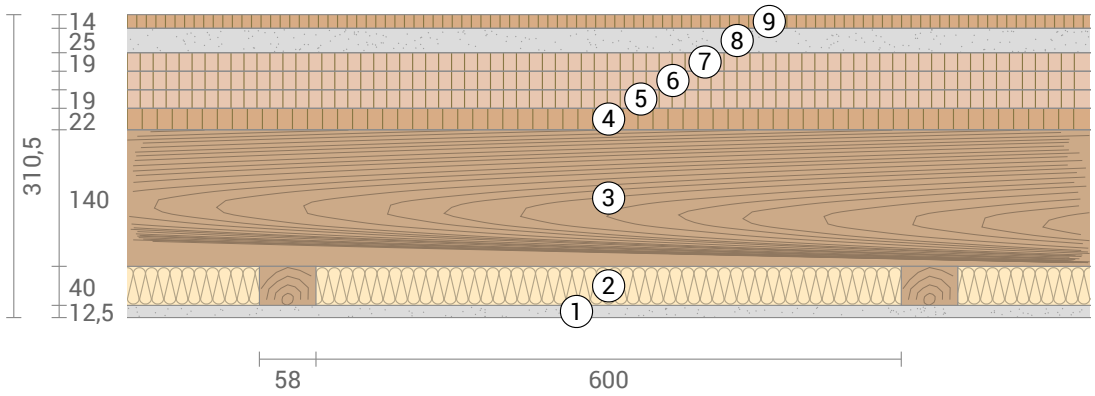
excellent — insufficient

Heat protection

Temperature amplitude damping: 80
phase shift: 18,5 h
Thermal capacity inside: 93 kJ/m²K

excellent — insufficient





1. Fermacell Gipsfaser-Platte 12,5mm (12,5 mm)
2. STEICOflex 036 (40 mm)
3. Spruce (140 mm)
4. OSB/3 (22 mm)
5. STEICOisorel (19 mm)
6. STEICOisorel (19 mm)
7. STEICOisorel (19 mm)
8. Fermacell Gipsfaser-Platte 12,5mm (25 mm)
9. 3-layer panel (14 mm)

Inside air :	20,0°C / 50%		Thickness: 31,0 cm
Inside air 2:	20,0°C / 50%	sd-value: 13,4 m	Weight: 143 kg/m²
Surface temperature.:	20,0°C / 20,0°C		Heat capacity: 216 kJ/m²K

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

*Comparison of the U-value with den Höchstwerten aus GEG Anlage 7 (GEG 2020-2024 Bestand); den techn. Mindestanforderungen für BEG Einzelmaßnahmen; 70% des U-Werts der Referenzausführung aus GEG 2023/2024 Anlage 1 (GEG Neubau); den R-Werten aus DIN 4108-2 Tabelle 3

Wohnhauses mit 4 celing, U=0,26 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)			0,100
1	Fermacell Gipsfaser-Platte 12,5mm	1,25	0,320	0,039
2	STEICOflex 036	4,00	0,036	1,111
	Spruce (8,8%)	4,00	0,130	0,308
3	Spruce	14,00	0,130	1,077
4	OSB/3	2,20	0,130	0,169
5	STEICOisorel	1,90	0,050	0,380
6	STEICOisorel	1,90	0,050	0,380
7	STEICOisorel	1,90	0,050	0,380
8	Fermacell Gipsfaser-Platte 12,5mm	2,50	0,320	0,078
9	3-layer panel	1,40	0,130	0,108
	Thermal contact resistance outside (Rse)			0,100

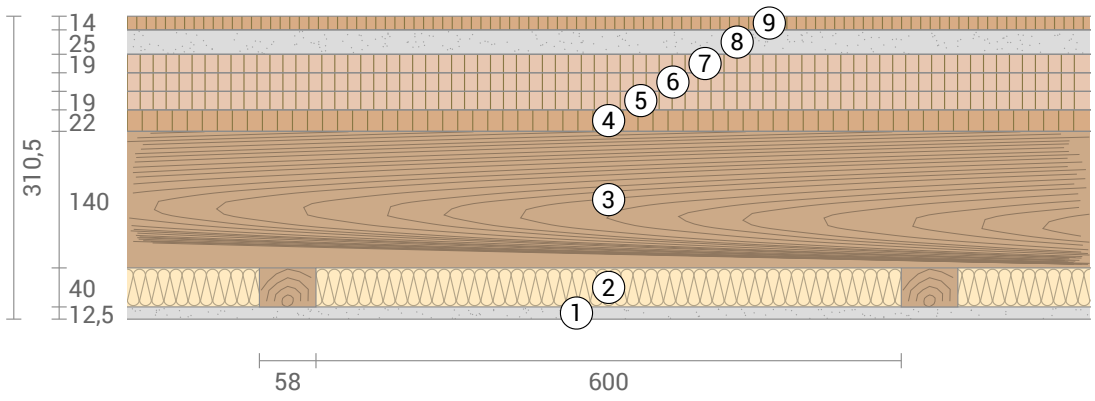
Thermal contact resistances have been taken from DIN 6946 Table 7.
Rsi: heat flow direction upwards
Rse: heat flow direction upwards, outside: Heated room

Upper limit of thermal resistance $R_{tot;upper}$ = 3,835 m²K/W.
Lower limit of thermal resistance $R_{tot;lower}$ = 3,714 m²K/W.
Check applicability: $R_{tot;upper}$ / $R_{tot;lower}$ = 1,033 (maximum allowed: 1,5)

The procedure may be used.

Thermal resistance R_{tot} = ($R_{tot;upper}$ + $R_{tot;lower}$)/2 = 3,775 m²K/W
Estimated maximum relative uncertainty according to section 6.7.2.5: 1,6%

Heat transfer coefficient U = 1/R_{tot} = **0,26 W/(m²K)**



Wohnhauses mit 4 celing, U=0,26 W/(m²K)

LCA

Heat loss: 21 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.

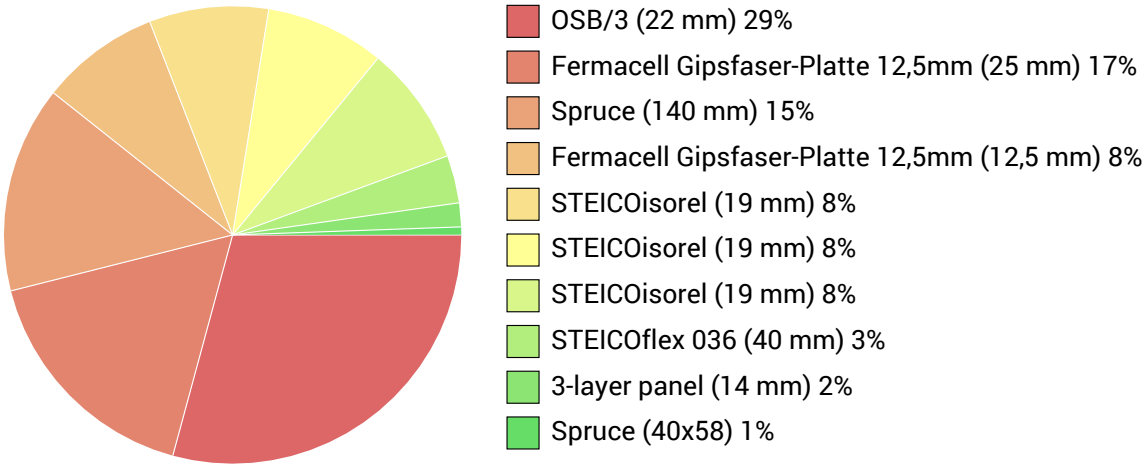
Primary energy (non renewable): 177 kWh/m²

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

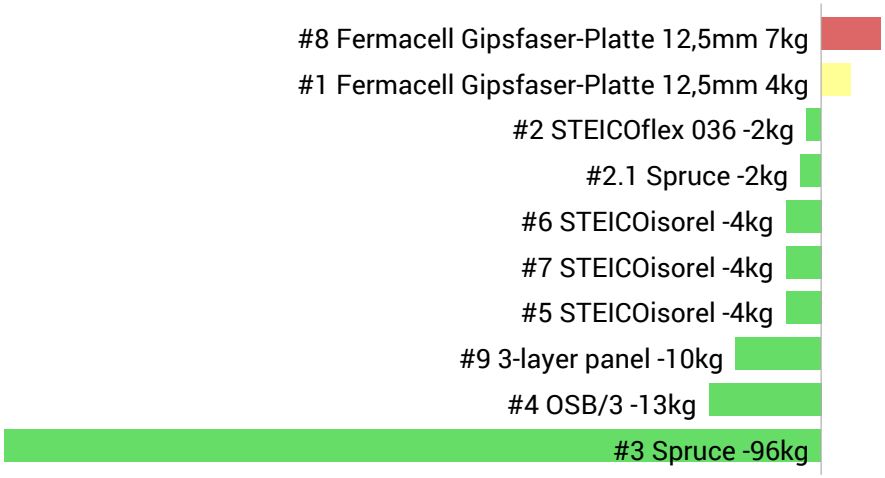
Green house gas potential: -125 kg CO2 Äqv./m²

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:

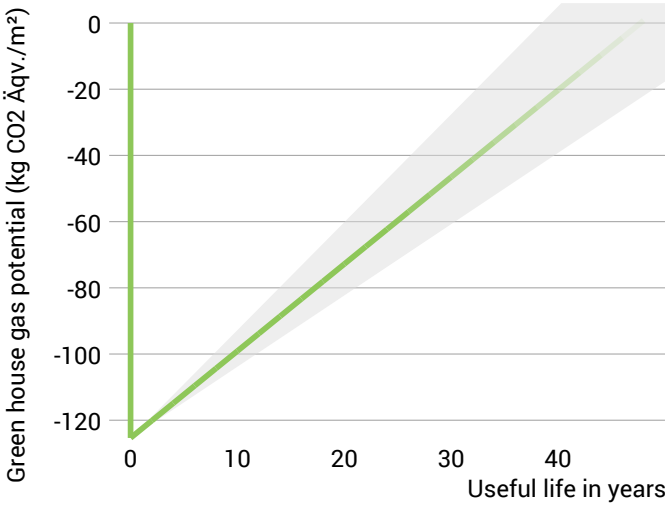


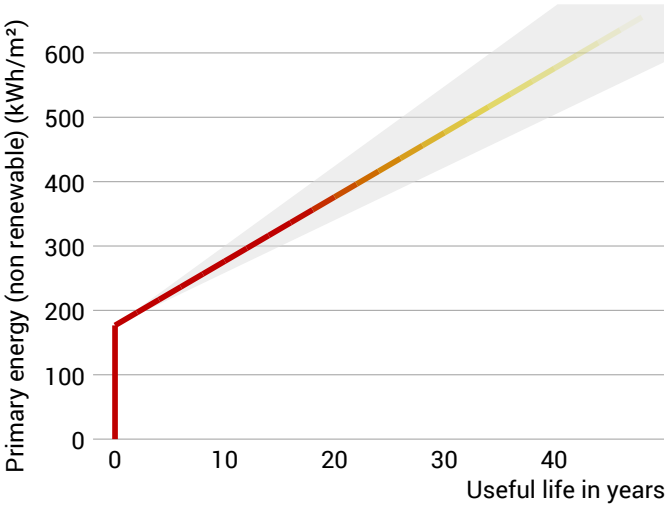
Composition of the greenhouse potential of production:



Wohnhauses mit 4 celing, U=0,26 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).

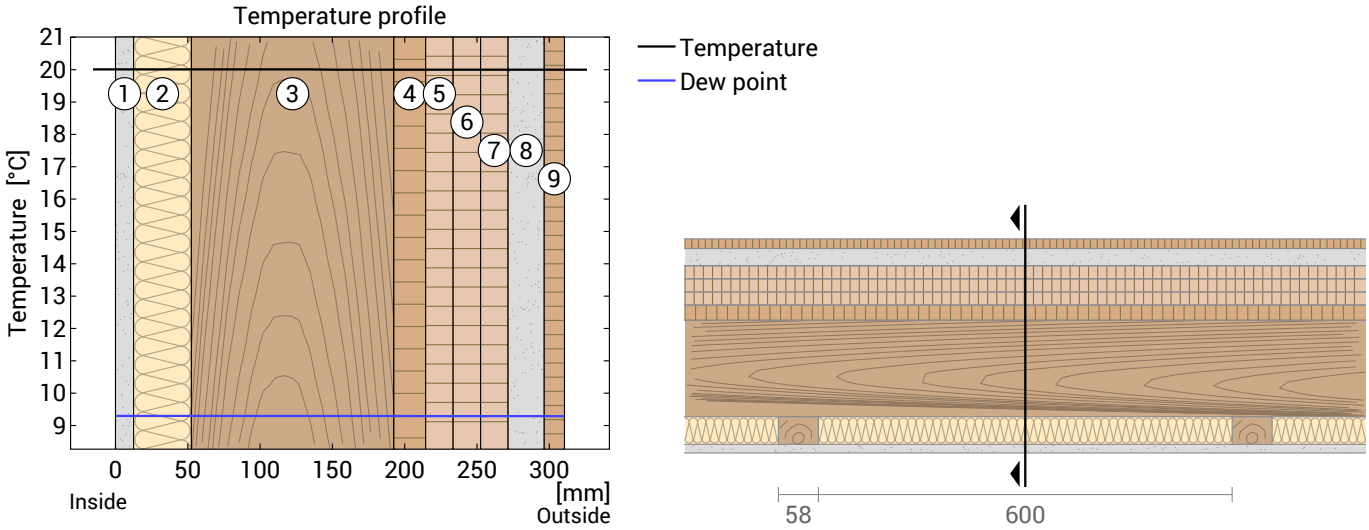
Hints

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.

Wohnhauses mit 4 celing, U=0,26 W/(m²K)

Temperature profile



① Fermacell Gipsfaser-Platte 12,5mm...
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④ OSB/3 (22 mm)
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⑥ STEICOisorel (19 mm)
⑦ STEICOisorel (19 mm)
⑧ Fermacell Gipsfaser-Platte 12,5m...
⑨ 3-layer panel (14 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	20,0	20,0	
1	1,25 cm	Fermacell Gipsfaser-Platte 12,5mm	0,320	0,039	20,0	20,0	14,4
2	4 cm	STEICOflex 036	0,036	1,111	20,0	20,0	1,8
	4 cm	Spruce (8,8%)	0,130	0,308	20,0	20,0	1,6
3	14 cm	Spruce	0,130	1,077	20,0	20,0	63,0
4	2,2 cm	OSB/3	0,130	0,169	20,0	20,0	13,6
5	1,9 cm	STEICOisorel	0,050	0,380	20,0	20,0	4,4
6	1,9 cm	STEICOisorel	0,050	0,380	20,0	20,0	4,4
7	1,9 cm	STEICOisorel	0,050	0,380	20,0	20,0	4,4
8	2,5 cm	Fermacell Gipsfaser-Platte 12,5mm	0,320	0,078	20,0	20,0	28,8
9	1,4 cm	3-layer panel	0,130	0,108	20,0	20,0	6,6
		Thermal contact resistance*		0,040	20,0	20,0	
	31,05 cm	Whole component		3,775			142,9

*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):	20,0°C	20,0°C	20,0°C
Surface temperature outside (min / average / max):	20,0°C	20,0°C	20,0°C

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Moisture proofing

For the calculation of the amount of condensation water, the component was exposed to the following constant climate for 90 days: inside: 20.01°C und 50% Humidity; outside: 20°C und 50% Humidity (Climate according to user input).

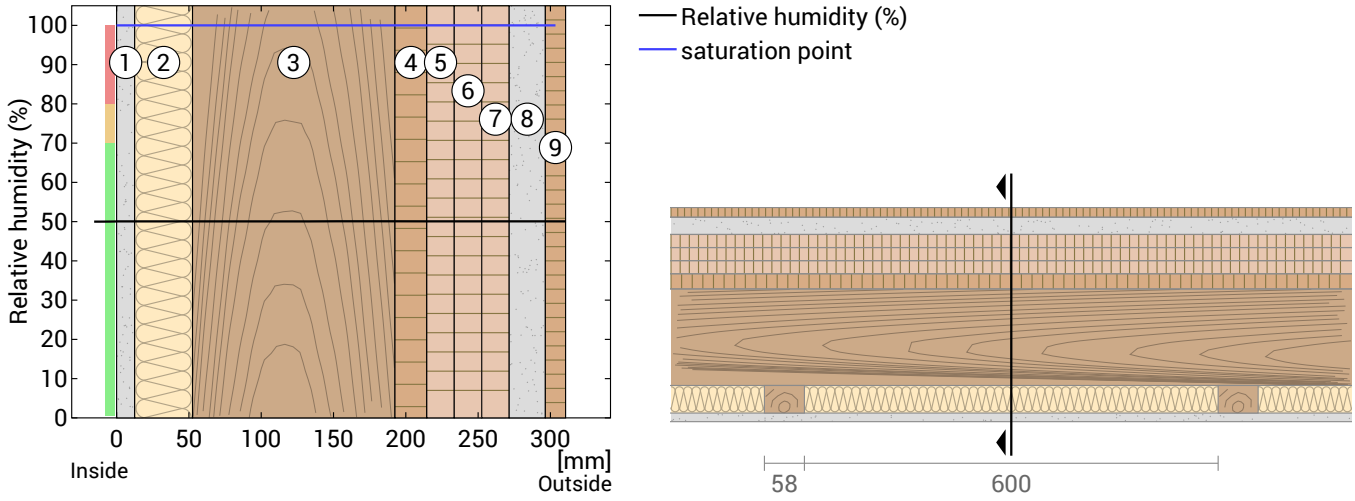
This component is free of condensate under the given climate conditions.

Drying reserve according to Ubakus 2D-FE method: 236 g/(m²a)
At least required by DIN 68800-2: 100 g/(m²a)

#		Material	sd-value [m]	Condensate [kg/m²]	[Gew.-%]	Weight [kg/m²]
1	1,25 cm	Fermacell Gipsfaser-Platte 12,5mm	0,16	-		14,4
2	4 cm	STEICOflex 036	0,08	-		1,8
	4 cm	Spruce (8,8%)	0,80	-	-	1,6
3	14 cm	Spruce	2,80	-	-	63,0
4	2,2 cm	OSB/3	6,60	-	-	13,6
5	1,9 cm	STEICOisorel	0,10	-	-	4,4
6	1,9 cm	STEICOisorel	0,10	-	-	4,4
7	1,9 cm	STEICOisorel	0,10	-	-	4,4
8	2,5 cm	Fermacell Gipsfaser-Platte 12,5mm	0,33	-		28,8
9	1,4 cm	3-layer panel	3,08	-	-	6,6
	31,05 cm	Whole component	13,38	0		142,9

Humidity

The temperature of the inside surface is 20,0 °C leading to a relative humidity on the surface of 50%.Mould formation is not expected under these conditions.
The following figure shows the relative humidity inside the component.



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⑨ 3-layer panel (14 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.

Wohnhauses mit 4 celing, U=0,26 W/(m²K)

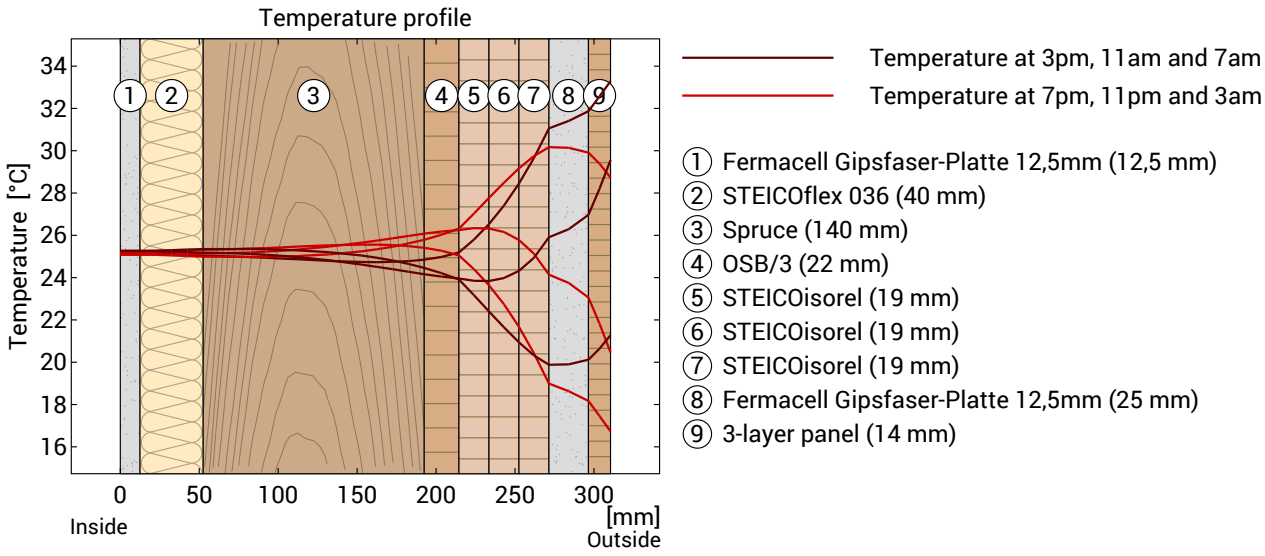
Moisture protection in accordance with DIN 4108-3:2018 Appendix A

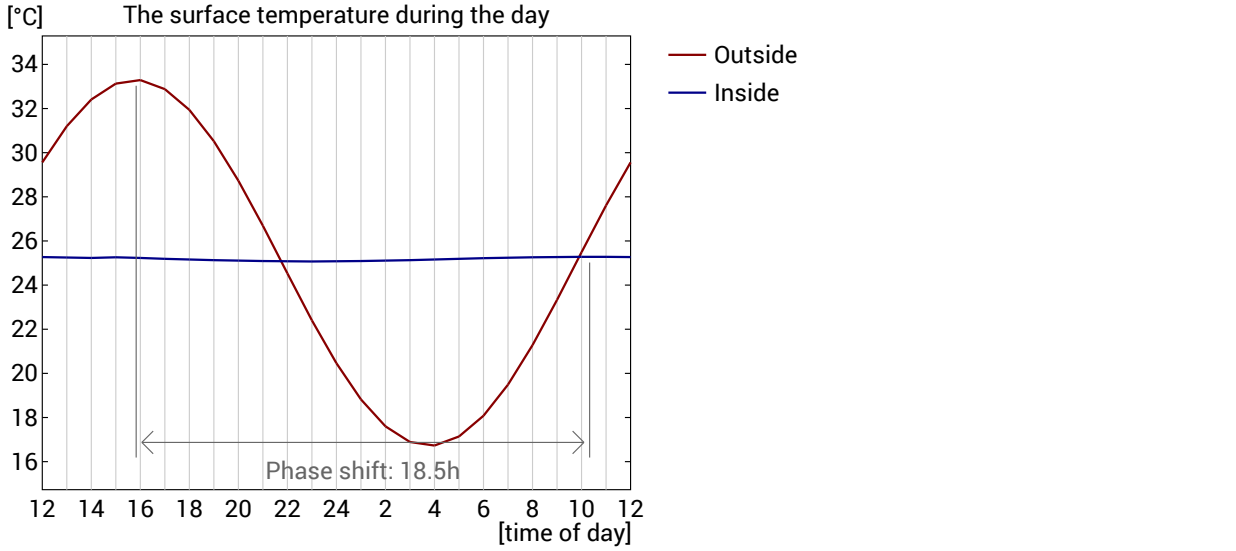
The temperatures and / or humidities you specify are not in accordance with DIN 4108-3. The following values are given by DIN 4108-3: 20°C / 50% humidity inside and -5°C / 80% humidity outside. Change the values in the input form to enable the calculation according to DIN 4108-3.

Wohnhauses mit 4 celing, U=0,26 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*	18,5 h	Heat storage capacity (whole component):	216 kJ/m²K
Amplitude attenuation **	80,0	Thermal capacity of inner layers:	93 kJ/m²K
TAV ***	0,013		

* 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.

Wohnhauses mit 4 celing, U=0,26 W/(m²K)

Hints

There are no hints available for your calculation.