Dach

Roof construction
created on 14.12.2022

Thermal protection

U = 0,14 W/(m²K)

GEG 2020 Bestand*: U<0,24 W/(m²K)

excellent insufficient

Moisture proofing

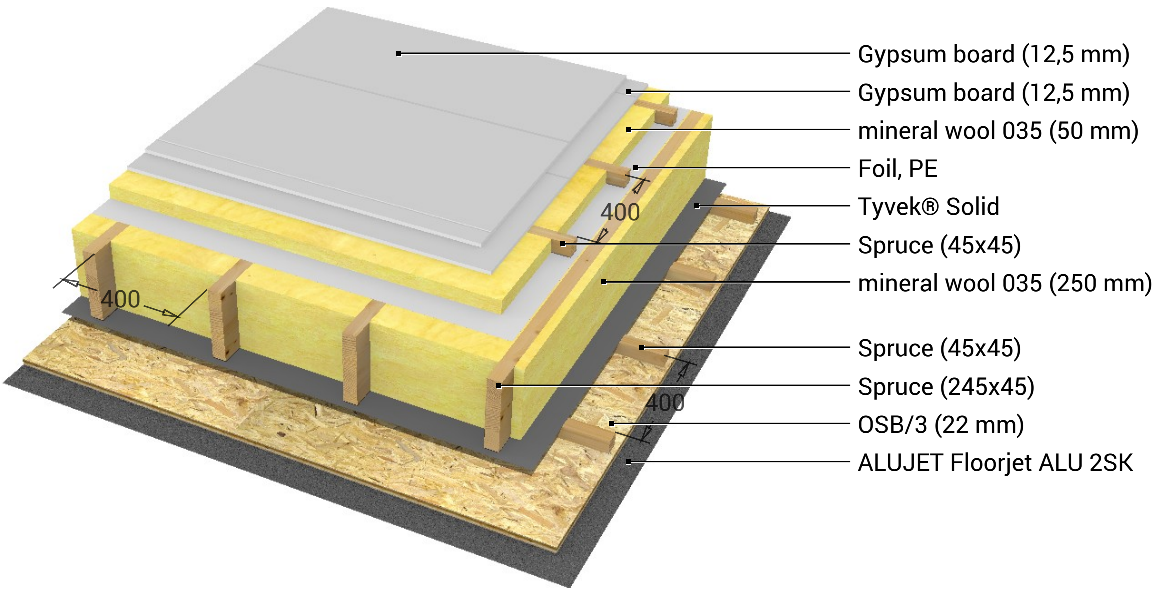
Condensate: 196 g/m²
Dries 12 days
Drying reserve: 1319 g/m²a

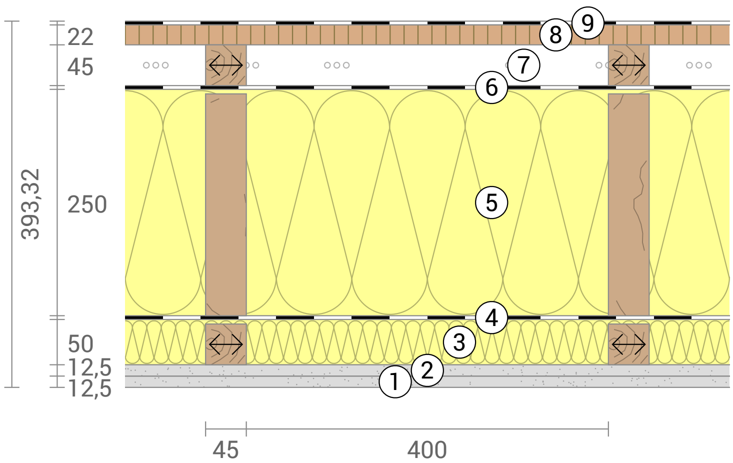
excellent insufficient

Heat protection

Temperature amplitude damping: 12
phase shift: 7,6 h
Thermal capacity inside: 26 kJ/m²K

excellent insufficient





1 Gypsum board (12,5 mm)
2 Gypsum board (12,5 mm)
3 mineral wool 035 (50 mm)
4 Foil, PE
5 mineral wool 035 (250 mm)
6 Tyvek® Solid
7 Rear ventilated level (45 mm)
8 OSB/3 (22 mm)
9 ALUJET Floorjet ALU 2SK

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

Inside air : 20,0°C / 50%
Outside air: -20,0°C / 30%
Surface temperature.: 19,4°C / -19,8°C

sd-value: 21,3 m

Thickness: 39,3 cm
Weight: 52 kg/m²
Heat capacity: 39 kJ/m²K

☑ GEG 2020 Bestand ☑ BEG Einzelmaßn. ☑ GEG 2020 Neubau ☑ DIN 4108

*Comparison of the U-value with den Höchstwerten aus GEG 2020 Anlage 7 (GEG 2020 Bestand); den techn. Mindestanforderungen für BEG Einzelmaßnahmen; 80% des U-Werts der Referenzausführung aus GEG 2020 Anlage 1 (GEG20 Neubau); den R-Werten aus DIN 4108-2 Tabelle 3

Dach, U=0,14 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	Gypsum board	1,25	0,250	0,050
2	Gypsum board	1,25	0,250	0,050
3	mineral wool 035	5,00	0,035	1,429
	Spruce (Width: 4,5 cm)	4,50	0,130	0,346
4	Foil, PE	0,02	0,400	0,001
5	mineral wool 035	25,00	0,035	7,143
	Spruce (Width: 4,5 cm)	24,50	0,130	1,885
6	Tyvek® Solid	0,02	0,230	0,001
	Thermal contact resistance outside (Rse)			0,100

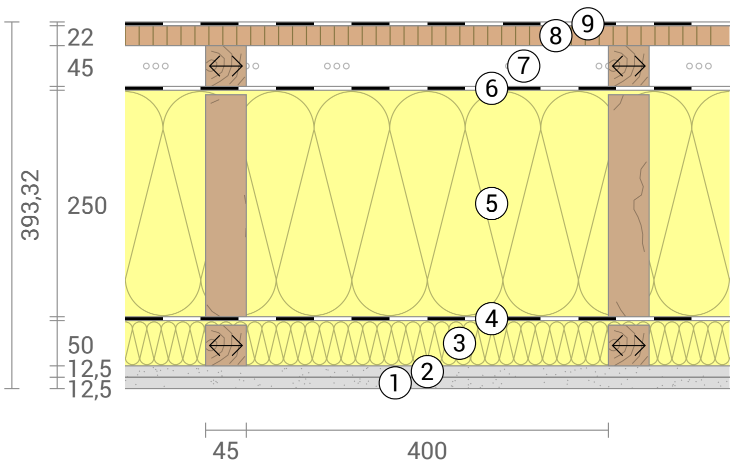
Thermal contact resistances have been taken from DIN 6946 Table 7.
Rsi: heat flow direction upwards
Rse: heat flow direction upwards, outside: Ventilation level

Upper limit of thermal resistance $R_{tot;upper}$ = 7,672 m²K/W.
Lower limit of thermal resistance $R_{tot;lower}$ = 7,088 m²K/W.
Check applicability: $R_{tot;upper}$ / $R_{tot;lower}$ = 1,082 (maximum allowed: 1,5)

The procedure may be used.

Thermal resistance $R_{tot} = (R_{tot;upper} + R_{tot;lower})/2$ = 7,380 m²K/W
Estimated maximum relative uncertainty according to section 6.7.2.5: 4,0%

Heat transfer coefficient $U = 1/R_{tot}$ = **0,14 W/(m²K)**



Dach, U=0,14 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.

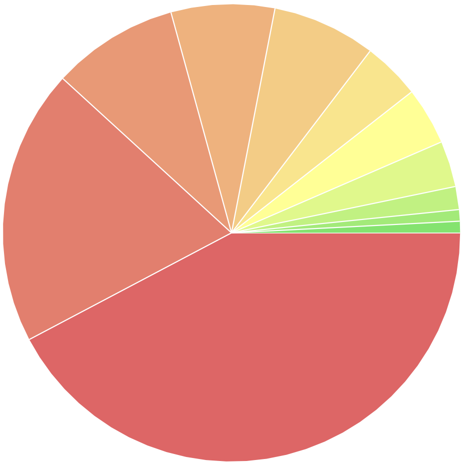
Primary energy (non renewable): 121 kWh/m²

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: -22 kg CO2 Äqv./m²

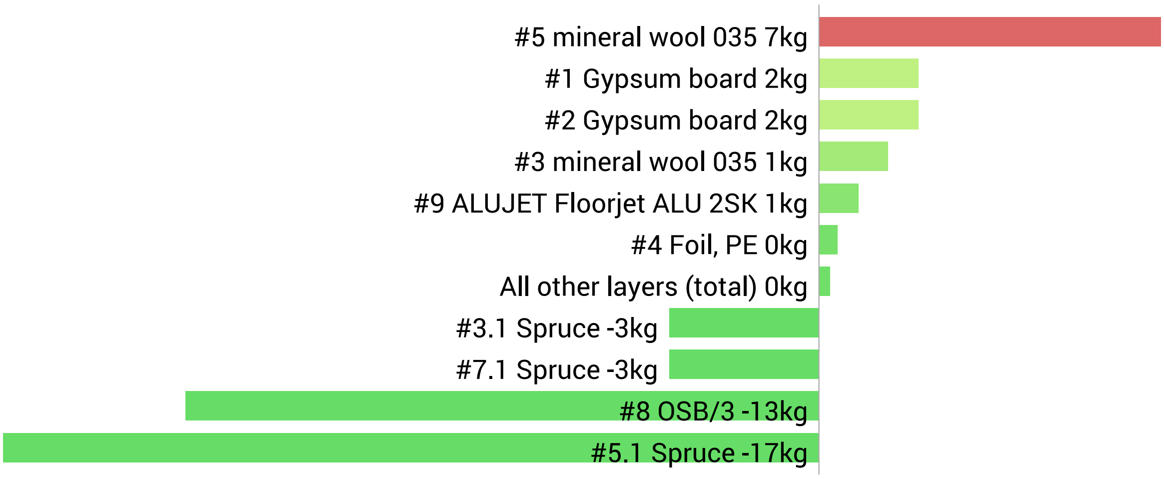
For the production of the building materials used, more greenhouse gases were withdrawn from the atmosphere than emitted.

Composition of non-renewable primary energy of production:



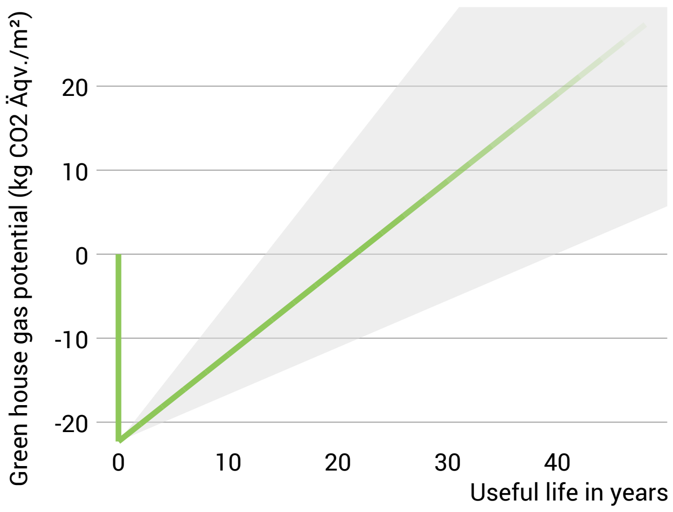
- OSB/3 (22 mm) 42%
- mineral wool 035 (250 mm) 20%
- ALUJET Floorjet ALU 2SK 9%
- Gypsum board (12,5 mm) 7%
- Gypsum board (12,5 mm) 7%
- mineral wool 035 (50 mm) 4%
- Spruce (245x45) 4%
- Foil, PE 3%
- Tyvek® Solid 2%
- Spruce (45x45) 1%
- Spruce (45x45) 1%

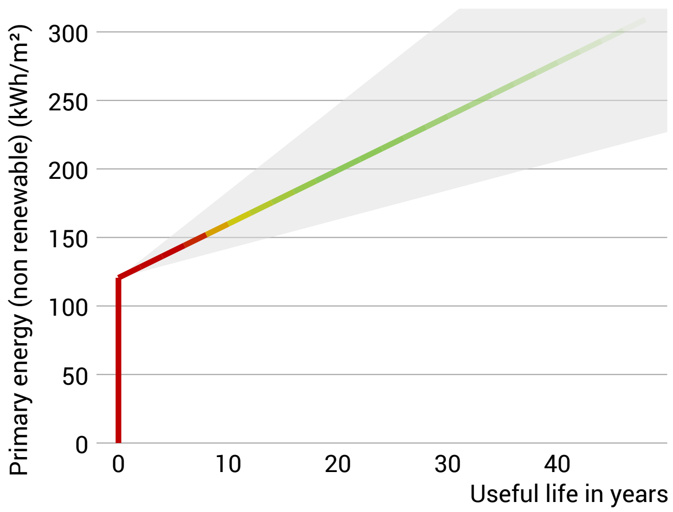
Composition of the greenhouse potential of production:



Dach, U=0,14 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).

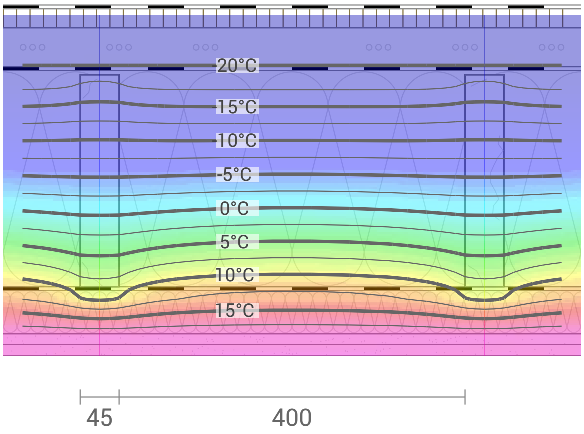
Hints

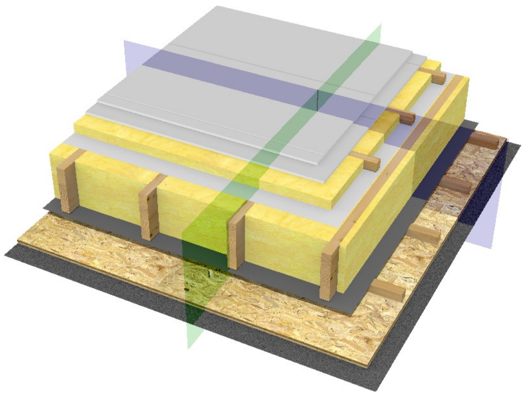
Calculated for the location DIN V 18599, heating period from Mid of October to End of April. The calculation is based on monthly average temperatures. Source: DIN V 18599-10:2007-02

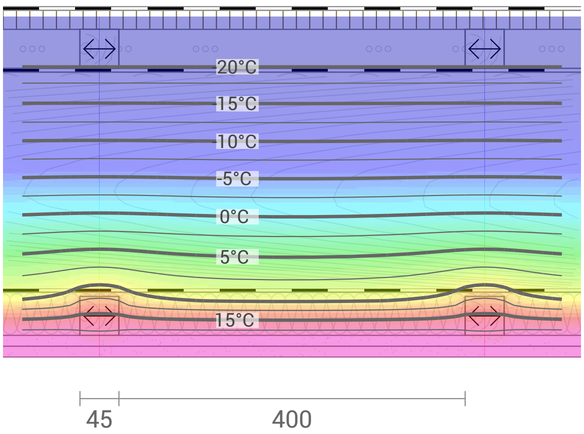
The climate and energy data on which this calculation is based can, in some cases, show considerable fluctuations and, in individual cases, deviate considerably from the actual value.

Dach, U=0,14 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*		0,100	19,4	20,0	
1	1,25 cm	Gypsum board	0,250	0,050	19,0	19,5	8,5
2	1,25 cm	Gypsum board	0,250	0,050	18,7	19,3	8,5
3	5 cm	mineral wool 035	0,035	1,429	8,2	19,0	0,9
	4,5 cm	Spruce (Width: 4,5 cm)	0,130	0,346			2,0
4	0,02 cm	Foil, PE	0,400	0,001	8,2	12,3	0,2
5	25 cm	mineral wool 035	0,035	7,143	-19,8	12,3	4,5
	24,5 cm	Spruce (Width: 4,5 cm)	0,130	1,885	-17,9	8,8	11,1
6	0,022 cm	Tyvek® Solid	0,230	0,001	-19,8	-19,5	0,1
		Thermal contact resistance*		0,040	-20,0	-19,5	
7	4,5 cm	Rear ventilated level (outside air)			-20,0	-20,0	0,0
8	2,2 cm	OSB/3			-20,0	-20,0	13,6
9	0,09 cm	ALUJET Floorjet ALU 2SK			-20,0	-20,0	0,9
	39,332 cm	Whole component		7,380			52,5

*Assuming free circulating air at the inside surface.

Surface temperature inside (min / average / max):	19,4°C	19,5°C	19,5°C
Surface temperature outside (min / average / max):	-19,8°C	-19,8°C	-19,5°C

Dach, U=0,14 W/(m²K)

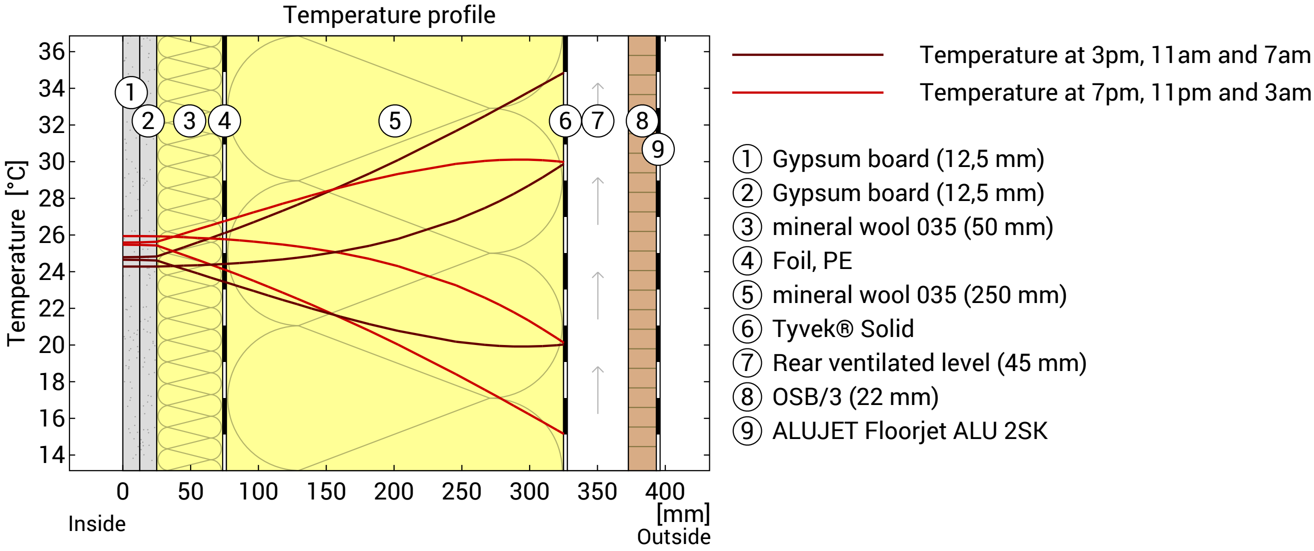
Moisture protection in accordance with DIN 4108-3:2018 Appendix A

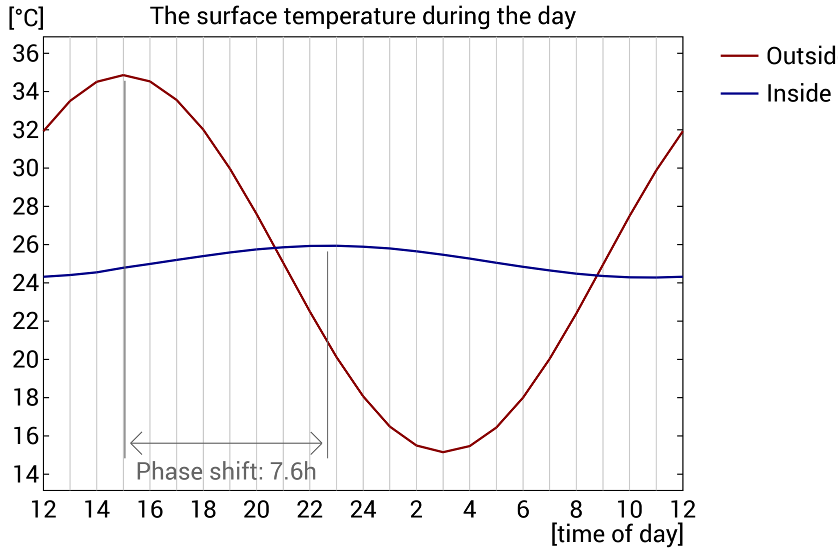
The temperatures and / or humidities you specify are not in accordance with DIN 4108-3. The following values are given by DIN 4108-3: 20°C / 50% humidity inside and -5°C / 80% humidity outside. Change the values in the input form to enable the calculation according to DIN 4108-3.

Dach, U=0,14 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*	7,6 h	Heat storage capacity (whole component):	39 kJ/m²K
Amplitude attenuation **	11,8	Thermal capacity of inner layers:	26 kJ/m²K
TAV ***	0,085		

* 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.