Roof-final

Flat roof
created on 24.10.2024

Thermal protection

U = 0,12 W/(m²K)

GEG 2020/24 Bestand*: U<0,2 W/(m²K)

excellent insufficient

Moisture proofing

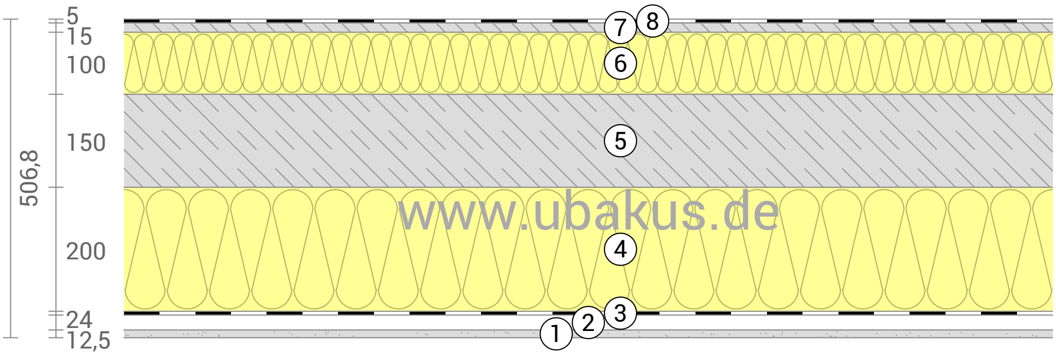
Dries 107 days
Condensate: 46 g/m²

excellent insufficient

Heat protection

Temperature amplitude damping: >100
phase shift: non relevant
Thermal capacity inside: 128 kJ/m²K

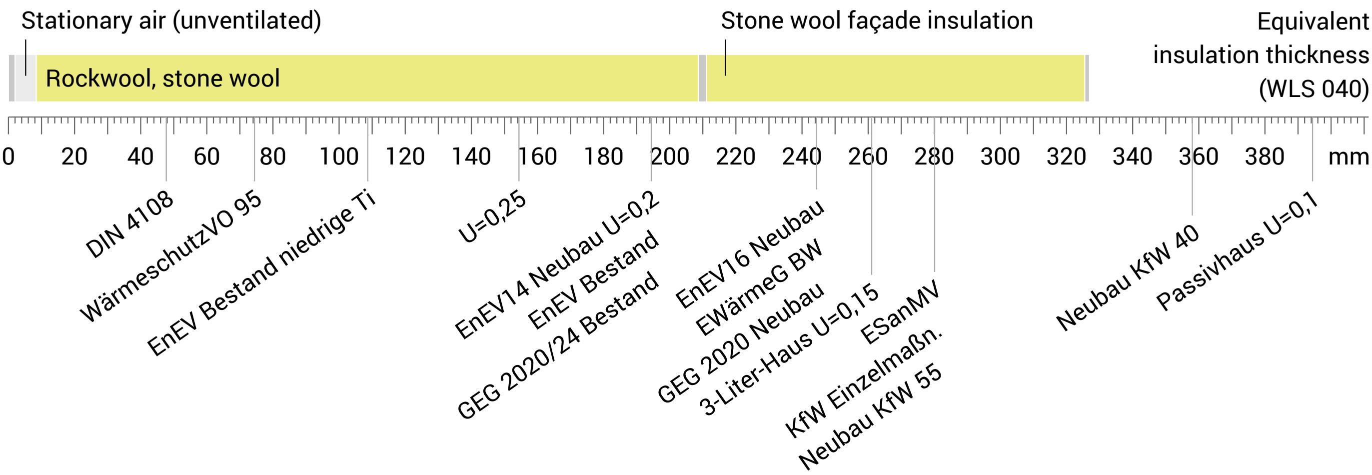
excellent insufficient



1. Gypsum board (12,5 mm)
2. Stationary air (24 mm)
3. Majrex 200
4. Rockwool, stone wool (200 mm)
5. Reinforced concrete (150 mm)
6. Stone wool façade insulation (100 mm)
7. Cement screed (15 mm)
8. Bitumen membranes

Impact of each layer and comparison to reference values

For the following figure, the thermal resistances of the individual layers were converted in millimeters insulation. The scale refers to an insulation of thermal conductivity 0,040 W/mK.

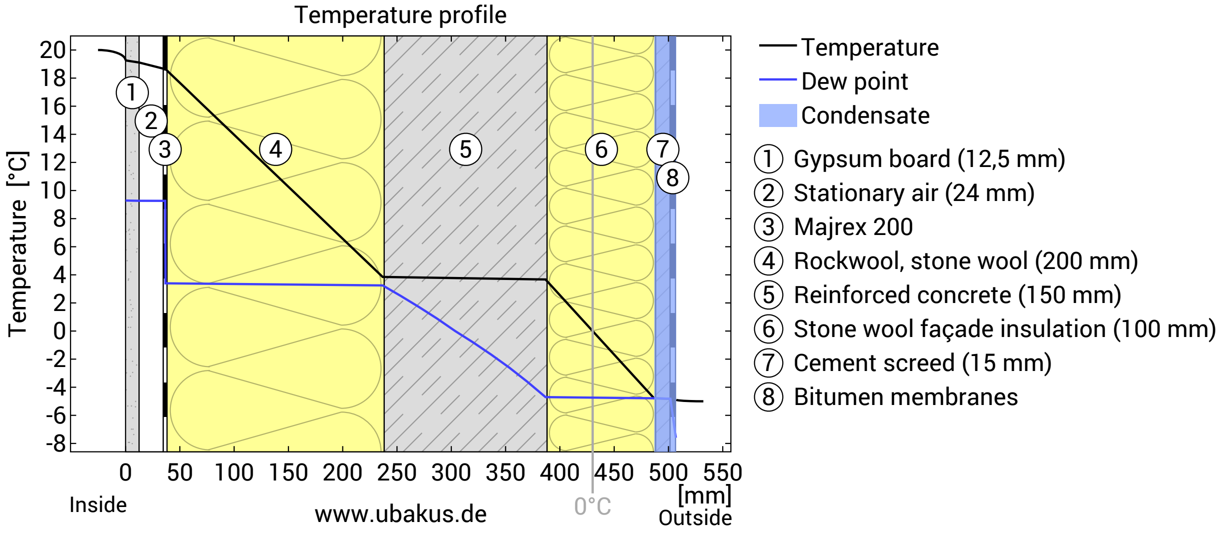


Inside air :	20,0°C / 50%		Thickness:	50,7 cm
Outside air:	-5,0°C / 80%	sd-value: 276,0 m	Weight:	426 kg/m²
Surface temperature.:	19,3°C / -4,9°C		Heat capacity:	379 kJ/m²K

*Vergleich mit dem Höchstwert gemäß GEG 2020-2024 für erstmaligen Einbau, Ersatz oder Erneuerung von Dachflächen mit Abdichtung (Anlage 7, Zeile 5c).

Roof-final, U=0,12 W/(m²K)

Temperature profile



Temperature and dew-point temperature in the component. 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 temperature, no condensation occurs. If the curves have contact, condensation occurs at the corresponding position.

Layers (from inside to outside)

#		Material	λ [W/mK]	R [m²K/W]	Temperatur [°C] min	max	Weight [kg/m²]
		Thermal contact resistance*		0,100	19,3	20,0	
1	1,25 cm	Gypsum board	0,250	0,050	19,1	19,3	8,5
2	2,4 cm	Stationary air (unventilated)	0,150	0,160	18,6	19,1	0,0
3	0,03 cm	Majrex 200	2,300	0,000	18,6	18,6	0,2
4	20 cm	Rockwool, stone wool	0,040	5,000	3,8	18,6	12,0
5	15 cm	Reinforced concrete (2%)	2,500	0,060	3,7	3,8	360,0
6	10 cm	Stone wool façade insulation	0,035	2,857	-4,8	3,7	10,0
7	1,5 cm	Cement screed	1,400	0,011	-4,8	-4,8	30,0
8	0,5 cm	Bitumen membranes	0,230	0,022	-4,9	-4,8	5,5
		Thermal contact resistance*		0,040	-5,0	-4,9	
	50,68 cm	Whole component		8,300			426,2

*Thermal contact resistances according to DIN 6946 for the U-value calculation. Rsi=0,25 and Rse=0,04 according to DIN 4108-3 were used for moisture proofing and temperature profile.

Surface temperature inside (min / average / max):	19,3°C	19,3°C	19,3°C
Surface temperature outside (min / average / max):	-4,9°C	-4,9°C	-4,9°C

Roof-final, U=0,12 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: 20°C und 50% Humidity; outside: -5°C und 80% Humidity. This climate complies with DIN 4108-3.

Under these conditions, a total of 0,046 kg of condensation water per square meter is accumulated.This amount would require 107 days to dry in the summer (Drying season according to DIN 4108-3:2018-10). This is more than the 90 days permitted by the DIN 4108-3, and it must be expected that the component does not dry out completely in the warm season!

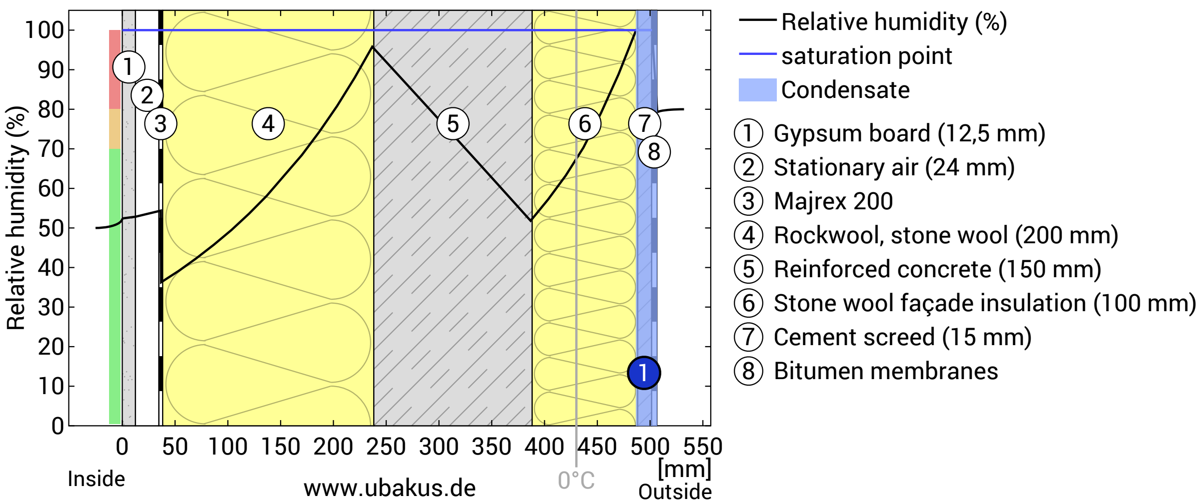
#		Material	sd-value [m]	Condensate [kg/m²]	[Gew.-%]	Weight [kg/m²]
1	1,25 cm	Gypsum board	0,05	-		8,5
2	2,4 cm	Stationary air (unventilated)	0,01	-		0,0
3	0,03 cm	Majrex 200	13,00	-		0,2
4	20 cm	Rockwool, stone wool	0,28	-		12,0
5	15 cm	Reinforced concrete (2%)	12,00	-		360,0
6	10 cm	Stone wool façade insulation	0,10	0,043		10,0
7	1,5 cm	Cement screed	0,53	0,046		30,0
8	0,5 cm	Bitumen membranes	250,00	-		5,5
	50,68 cm	Whole component	275,96	0,046		426,2

Condensation areas

1 Condensate: 0,046 kg/m² Affected layers: Cement screed, Stone wool façade insulation, Bitumen membranes

Humidity

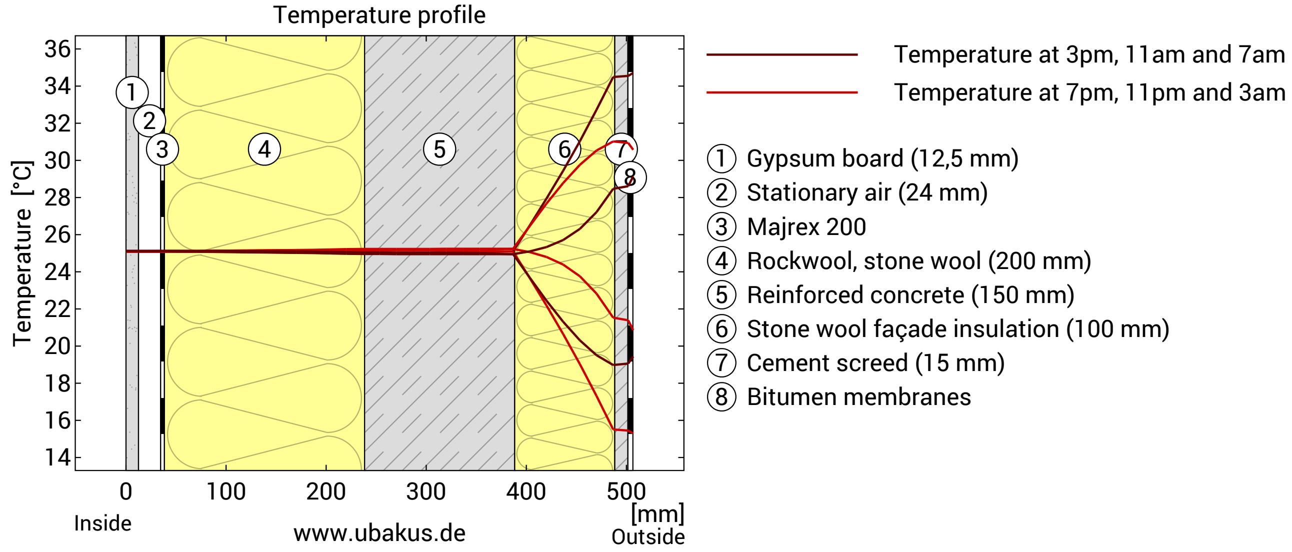
The temperature of the inside surface is 19,3 °C leading to a relative humidity on the surface of 52%.Mould formation is not expected under these conditions.
The following figure shows the relative humidity inside the component.

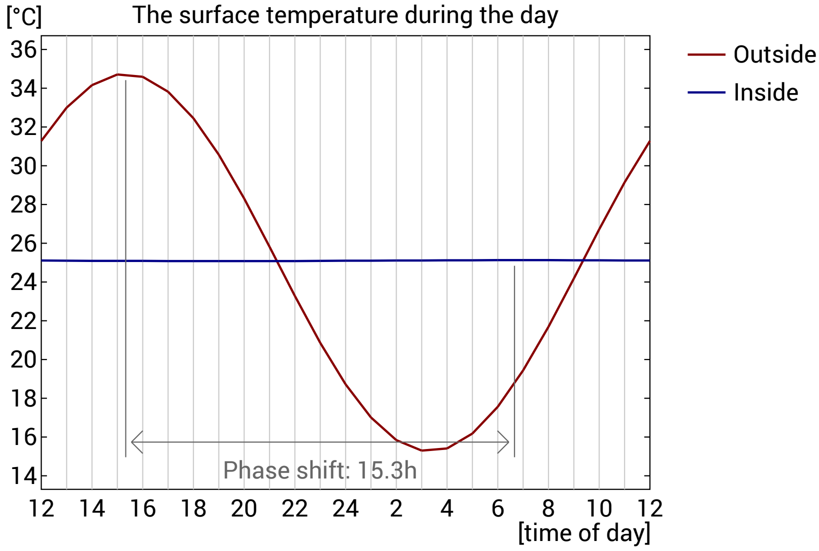


Notes: Calculation using the Ubakus 2D-FE method. Convection and the capillarity of the building materials were not considered. The drying time may take longer under unfavorable conditions (shading, damp / cool summers) than calculated here.

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):	379 kJ/m²K
Amplitude attenuation **	>100	Thermal capacity of inner layers:	128 kJ/m²K
TAV ***	0,003		

* 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.