I Domus roof Steico protect 037

Roof construction
created on 27.3.2020

Thermal protection

U = 0,155 W/(m²K)

EnEV16 Neubau*: U<0,16 W/(m²K)

excellent insufficient

Moisture proofing

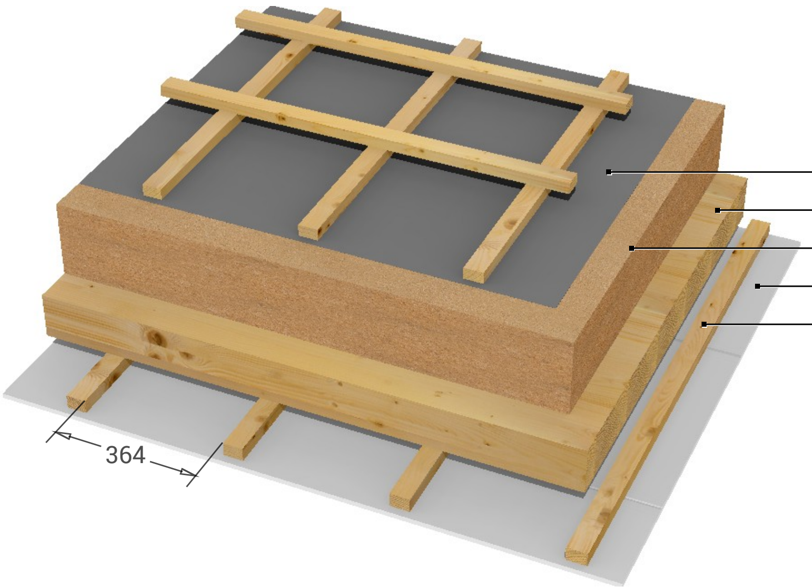
Drying reserve: 7781 g/m²a
No condensate

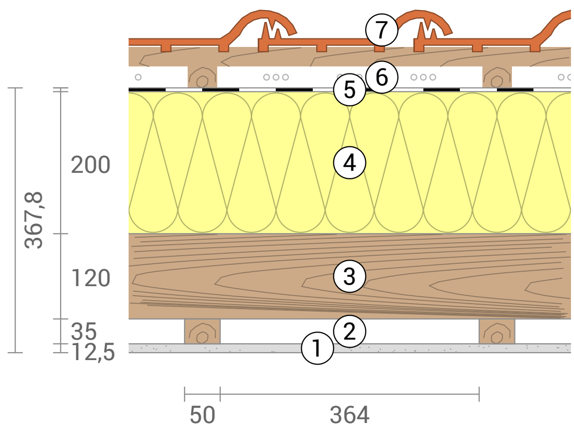
excellent insufficient

Heat protection

Temperature amplitude damping: >100
phase shift: non relevant
Thermal capacity inside: 105 kJ/m²K

excellent insufficient





1. Plasterboard (12,5 mm)
2. stationary air (35 mm)
3. HBE (120 mm)
4. STEICOprotect L dry (200 mm)
5. Dörken Delta-Maxx
6. Rear ventilated level
7. Roofing tiles

Inside air :	20,0°C / 50%		Thickness:	50,1 cm
Outside air:	10,0°C / 84%	sd-value: 1,0 m	Weight:	138 kg/m²
Surface temperature.:	19,6°C / 10,1°C		Heat capacity:	144 kJ/m²K

☑ EnEV16 Neubau ☐ ESanMV ☑ EnEV14 Neubau ☑ EnEV Bestand

*Comparison of the U-value with den Höchstwerten aus EnEV 2014 Anlage 3 Tabelle 1 (EnEV Bestand); den Höchstwerten der Energetische Sanierungsmaßnahmen-Verordnung (ESanMV); 80% des U-Werts der Referenzausführung aus EnEV 2014 Anlage 1 Tabelle 1 (EnEV16 Neubau); der Referenzausführung aus EnEV 2014 Anlage 1 Tabelle 1 (EnEV14 Neubau)

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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	Plasterboard	1,25	0,250	0,050
2	stationary air (unventilated)	3,50	0,219	0,160
	spruce (12%)	3,50	0,130	0,269
3	HBE	12,00	0,130	0,923
4	STEICOprotect L dry	20,00	0,039	5,128
5	Dörken Delta-Maxx	0,03	0,500	0,001
	Thermal contact resistance outside (Rse)			0,100
	Whole component	50,08		

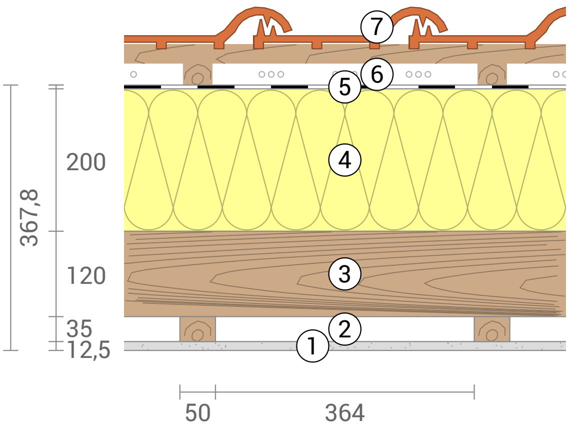
Thermal contact resistances have been taken from DIN 6946 Table 7.
Rsi: heat flow direction upwards
Rse: heat flow direction upwards, outside: Rear ventilated roofing

Upper limit of thermal resistance $R_{tot;upper}$ = 6,475 m²K/W.
Lower limit of thermal resistance $R_{tot;lower}$ = 6,470 m²K/W.
Check applicability: $R_{tot;upper}$ / $R_{tot;lower}$ = 1,001 (maximum allowed: 1,5)

The procedure may be used.

Thermal resistance $R_{tot} = (R_{tot;upper} + R_{tot;lower})/2$ = 6,473 m²K/W
Estimated maximum relative uncertainty according to section 6.7.2.5: 0,037%

Heat transfer coefficient U = $1/R_{tot}$ = **0,15 W/(m²K)**



COMMONS HOUSE DESIGN

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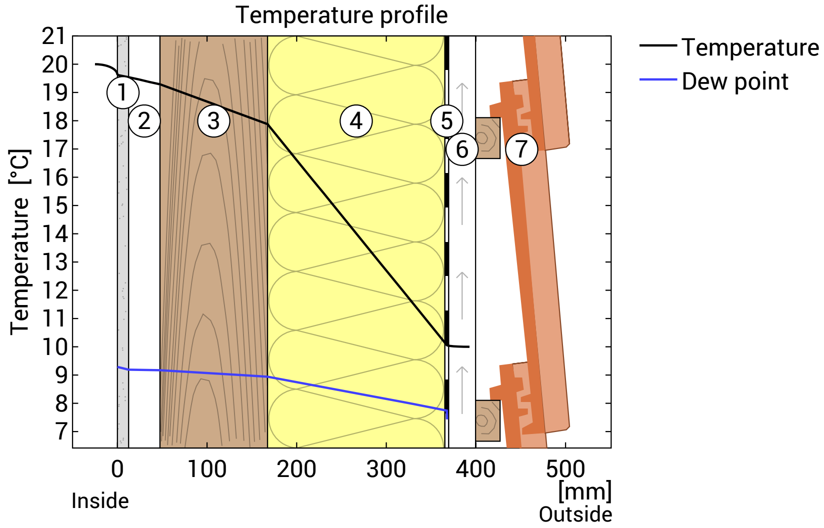
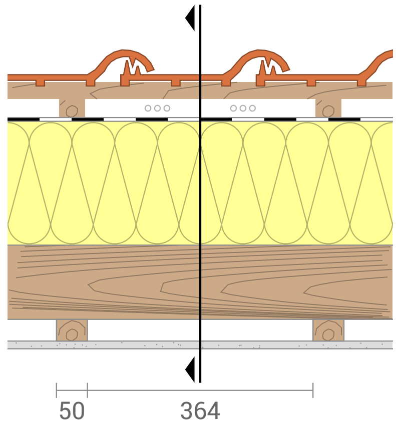
Temperature profile





① Plasterboard (12,5 mm)
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④ STEICOprotect L dry (200 mm)
⑤ Dörken Delta-Maxx
⑥ Rear ventilated level
⑦ Roofing tiles

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	19,6	20,0	
1	1,25 cm	Plasterboard	0,250	0,050	19,5	19,6	8,5
2	3,5 cm	stationary air (unventilated)	0,219	0,160	19,3	19,6	0,0
	3,5 cm	spruce (12%)	0,130	0,269	19,2	19,6	1,9
3	12 cm	HBE	0,130	0,923	17,9	19,3	54,0
4	20 cm	STEICOprotect L dry	0,039	5,128	10,1	17,9	22,0
5	0,03 cm	Dörken Delta-Maxx	0,500	0,001	10,1	10,1	0,2
		Thermal contact resistance*		0,040	10,0	10,1	
6		Rear ventilated level (outside air)			10,0	10,0	0,0
7		Roofing tiles (clay)			10,0	10,0	51,5
	50,08 cm	Whole component		6,472			138,1

*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):	19,6°C	19,6°C	19,6°C
Surface temperature outside (min / average / max):	10,1°C	10,1°C	10,1°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°C und 50% Humidity; outside: 10°C und 84% Humidity (Climate according to user input).

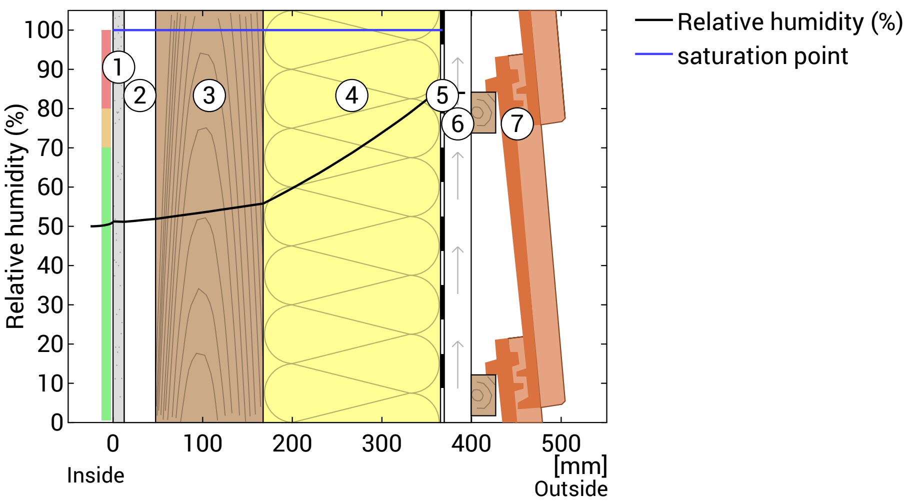
This component is free of condensate under the given climate conditions.

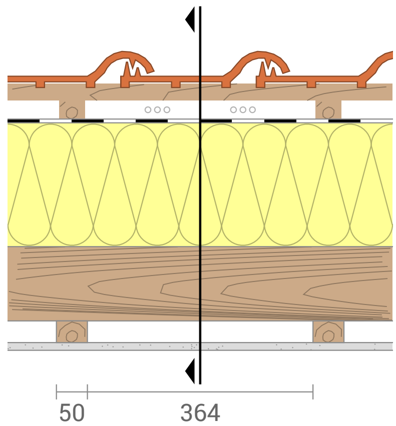
Drying reserve according to Ubakus 2D-FE method: 7781 g/(m²a)
At least required by DIN 68800-2: 250 g/(m²a)

#		Material	sd-value [m]	Condensate [kg/m²]	[Gew.-%]	Weight [kg/m²]
1	1,25 cm	Plasterboard	0,05	-		8,5
2	3,5 cm	stationary air (unventilated)	0,01	-		0,0
	3,5 cm	spruce (12%)	0,70	-	-	1,9
3	12 cm	HBE	0,12	-	-	54,0
4	20 cm	STEICOprotect L dry	0,60	-		22,0
5	0,03 cm	Dörken Delta-Maxx	0,15	-		0,2
	50,08 cm	Whole component	0,97			138,1

Humidity

The temperature of the inside surface is 19,6 °C leading to a relative humidity on the surface of 51%.Mould formation is not expected under these conditions.
The following figure shows the relative humidity inside the component.





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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

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.

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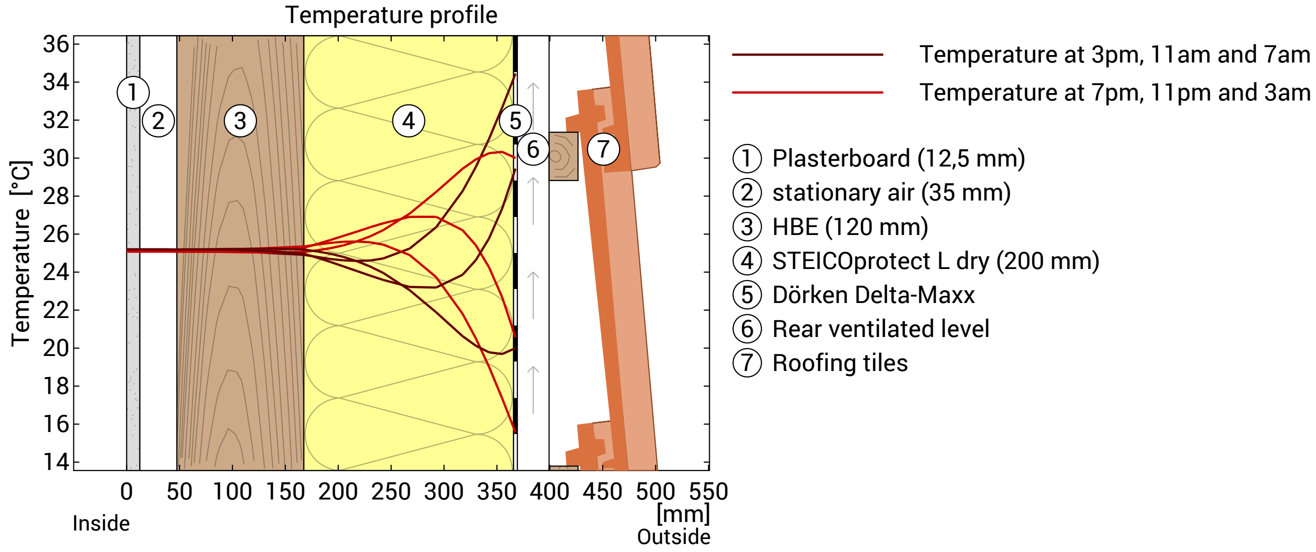
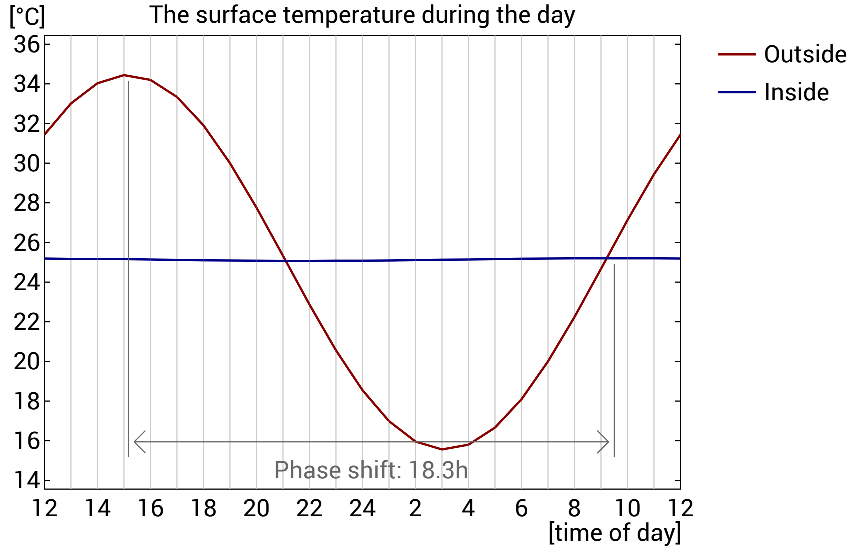
Heat protection

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):	144 kJ/m²K
Amplitude attenuation **	>100	Thermal capacity of inner layers:	105 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.

Hints

Rear ventilation level

The thickness of the rear ventilation level is 3 cm. Generally, the thickness should be at least 3 cm. If the inclination of the rear ventilation plane is less than 40°, e.g. for (flat) roofs, a larger value must be selected. The same applies if the air inlet and the air outlet are particularly far apart.

The part of your component that is relevant to the calculation ends at the inside of the rear ventilation level. Outlying layers do not need to be entered.

Beams and joists which penetrate the rear ventilation level are only considered up to the inside of the rear ventilation level.

Please note: The U-value calculator basically assumes that a rear ventilation level is adequately permeated by outside air. Whether this is actually the case depends not only on the thickness of the rear ventilation level, but also on their width and length and possible obstacles in the air inlet and outlet and can not be assessed by the U-value calculator.