

Muro de paja con revocos

Exterior wall
created on 3.7.2019

Thermal protection

$U = 0,09 \text{ W}/(\text{m}^2\text{K})$

EnEV Bestand*: $U < 0,24 \text{ W}/(\text{m}^2\text{K})$



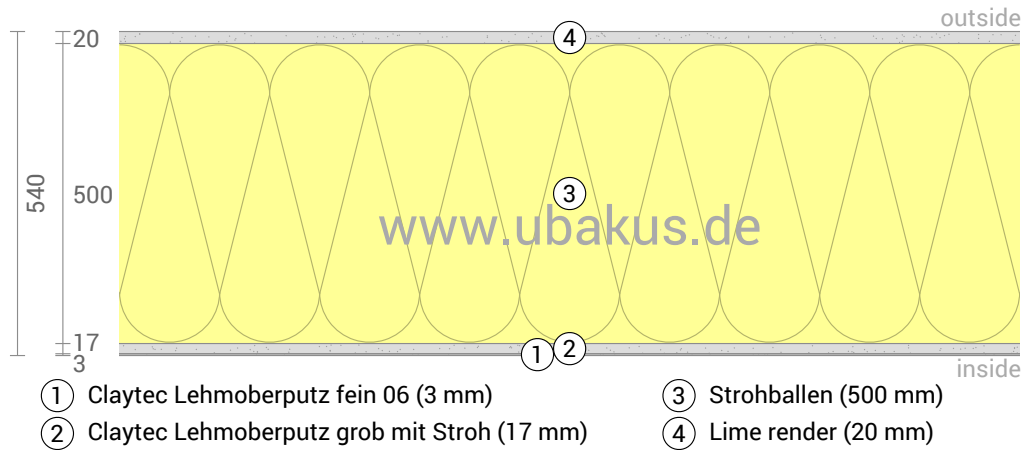
Moisture proofing

Condensate: $106 \text{ g}/\text{m}^2$
Dries 3 days



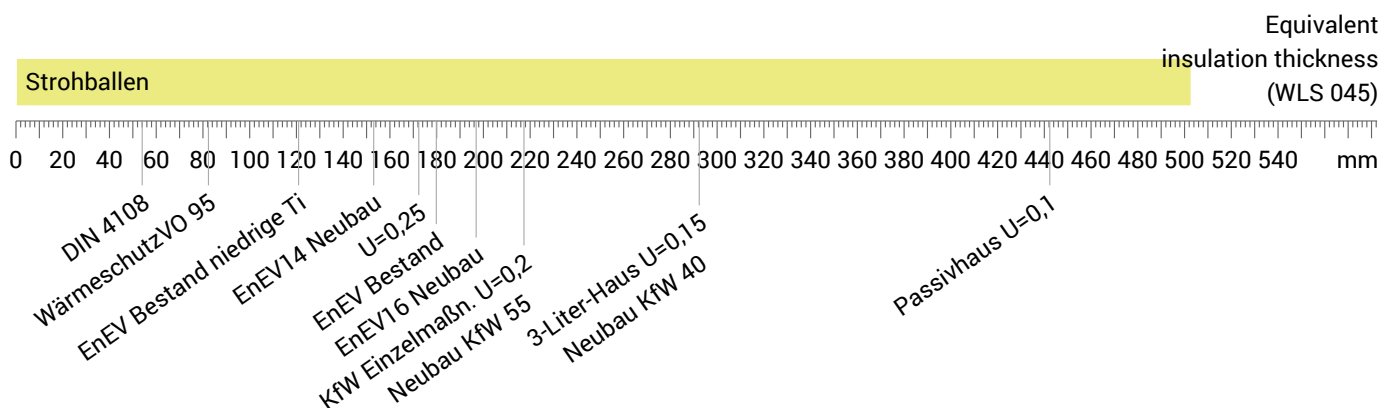
Heat protection

Temperature amplitude damping: > 100
phase shift: non relevant
Thermal capacity inside: $91 \text{ kJ}/\text{m}^2\text{K}$



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 $0,045 \text{ W}/\text{mK}$.



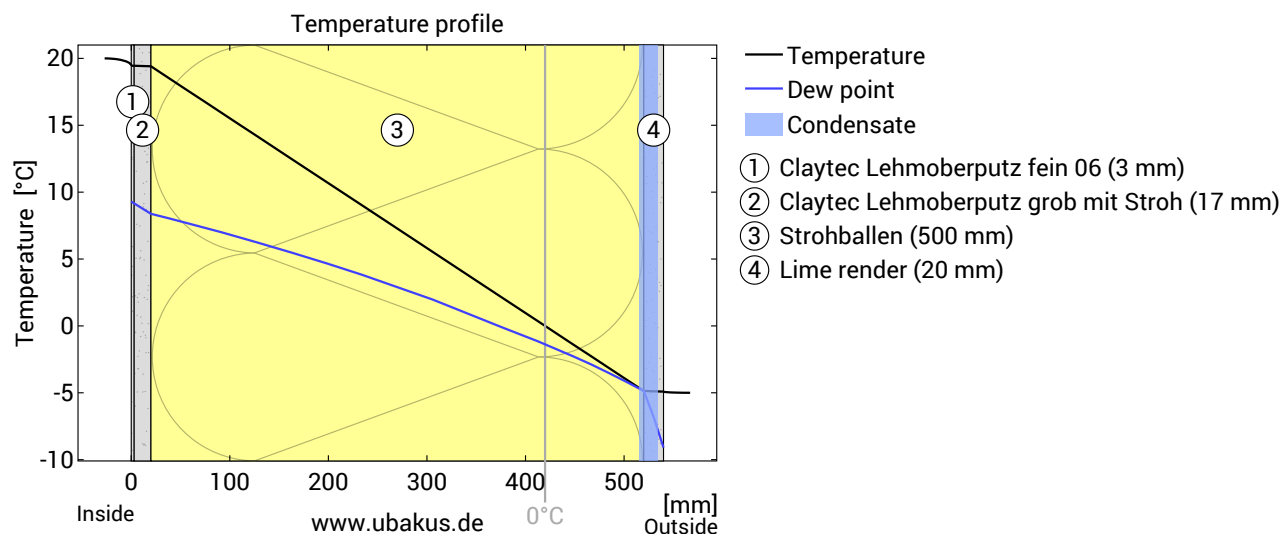
Inside air : $20,0^\circ\text{C} / 50\%$
Outside air: $-5,0^\circ\text{C} / 70\%$
Surface temperature.: $19,5^\circ\text{C} / -4,9^\circ\text{C}$

sd-value: 1,3 m

Thickness: 54,0 cm
Weight: $114 \text{ kg}/\text{m}^2$
Heat capacity: $169 \text{ kJ}/\text{m}^2\text{K}$

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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]		Weight [kg/m²]
				min	max	
	Thermal contact resistance*		0,130	19,5	20,0	
1	0,3 cm Claytec Lehmoberputz fein 06	0,910	0,003	19,4	19,5	5,4
2	1,7 cm Claytec Lehmoberputz grob mit Stroh	0,910	0,019	19,4	19,4	30,6
3	50 cm Strohballen	0,045	11,111	-4,9	19,4	50,0
4	2 cm Lime render	0,870	0,023	-4,9	-4,9	28,0
	Thermal contact resistance*		0,040	-5,0	-4,9	
	54 cm Whole component		11,326			114,0

*Thermal contact resistances according to DIN 6946 for the U-value calculation. $R_{si}=0,25$ and $R_{se}=0,04$ according to DIN 4108-3 were used for moisture proofing and temperature profile.

Surface temperature inside (min / average / max): 19,5°C 19,5°C 19,5°C
Surface temperature outside (min / average / max): -4,9°C -4,9°C -4,9°C

Muro de paja con revocos, $U=0,09 \text{ W}/(\text{m}^2\text{K})$

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 70% Humidity (Climate according to user input).

Under these conditions, a total of 0,11 kg of condensation water per square meter is accumulated. This quantity dries in summer in 3 days (Drying season according to DIN 4108-3:2018-10).

#	Material	sd-value [m]	Condensate [kg/m ²] [Gew.-%]	Weight [kg/m ²]
1	0,3 cm Claytec Lehmoberputz fein 06	0,02	-	5,4
2	1,7 cm Claytec Lehmoberputz grob mit Stroh	0,09	-	30,6
3	50 cm Strohballen	1,00	0,11	50,0
4	2 cm Lime render	0,20	0,11	28,0
	54 cm Whole component	1,30	0,11	114,0

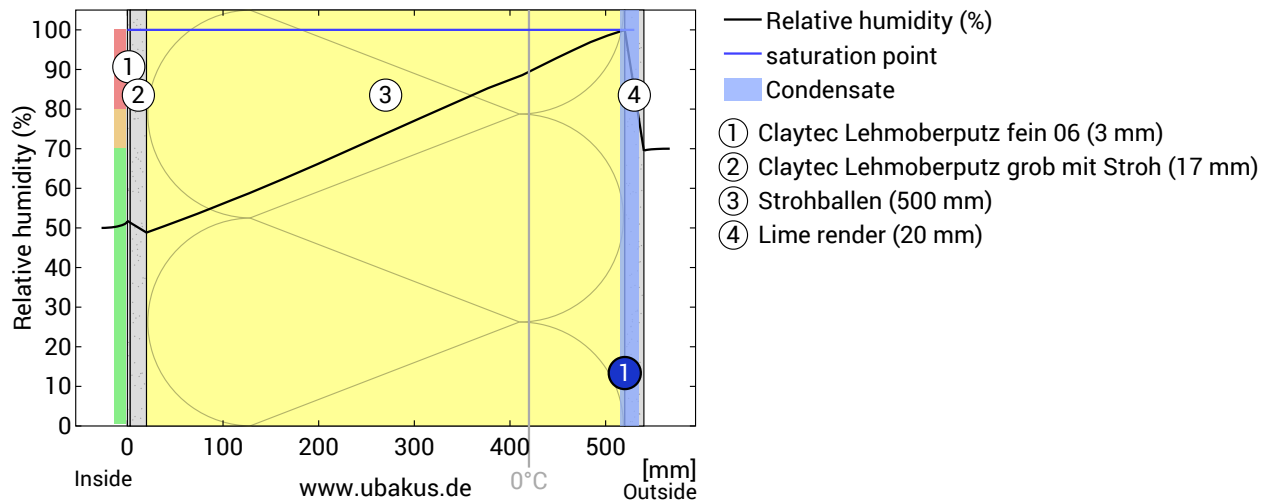
Condensation areas

- ① Condensate: 0,11 kg/m² Affected layers: Lime render, Strohballen

Humidity

The temperature of the inside surface is 19,5 °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.

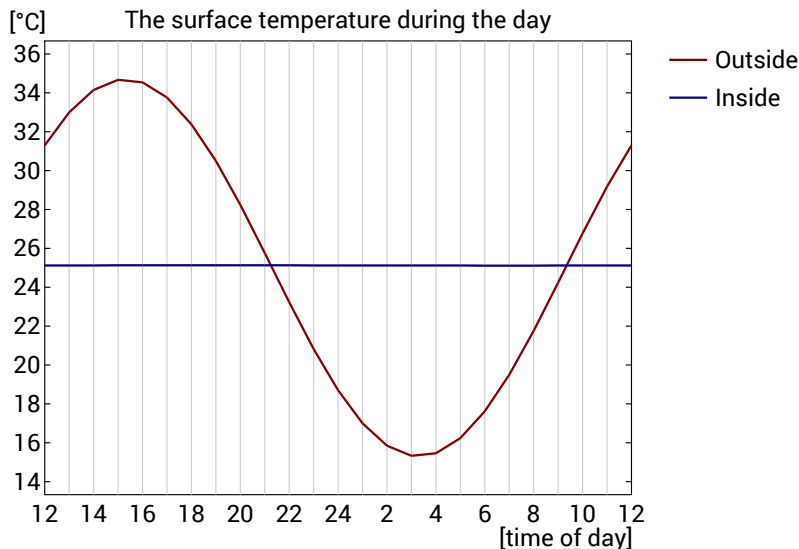
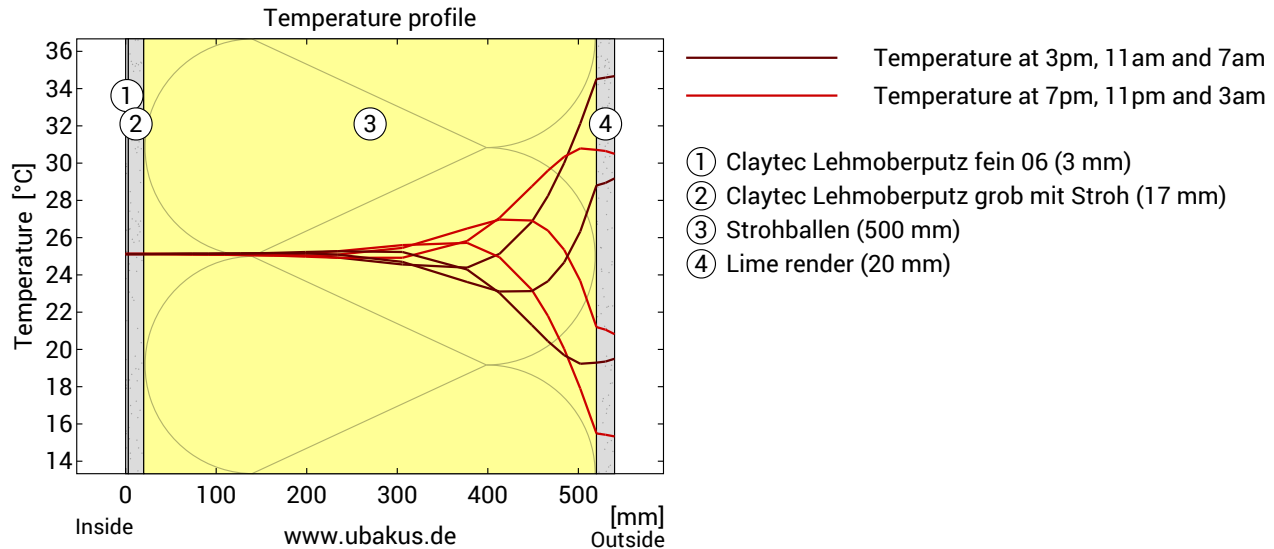


Notes: Calculation using the Ubakus 2D-FE method. Convection and the capillarity of the building materials were not considered. The drying time may take longer under unfavorable conditions (shading, damp / cool summers) than calculated here.

Muro de paja con revocos, $U=0,09 \text{ W}/(\text{m}^2\text{K})$

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):	169 kJ/m ² K
Amplitude attenuation **	>100	Thermal capacity of inner layers:	91 kJ/m ² K
TAV ***	0,001		

* 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: $TAV = 1 / \text{amplitude attenuation}$

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.