BRICK WALL

Exterior wall
created on 23.10.2020

Thermal protection

U = 2,15 W/(m²K)

EnEV Bestand*: U<0,24 W/(m²K)

excellent insufficient

Moisture proofing

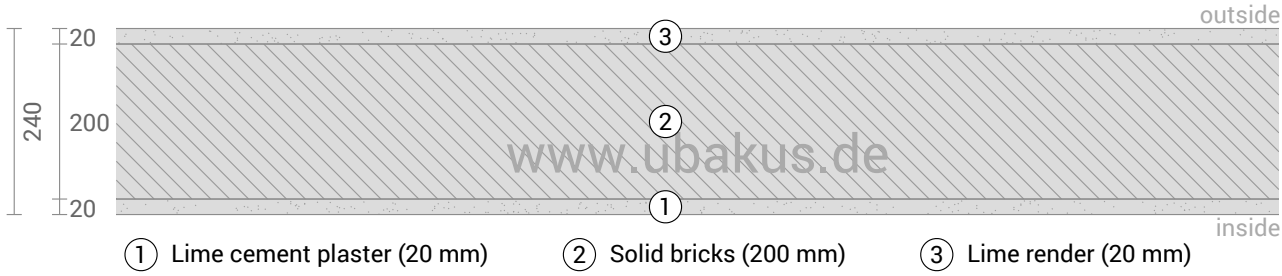
No condensate

excellent insufficient

Heat protection

Temperature amplitude damping: 4,1
phase shift: 8,0 h
Thermal capacity inside: 172 kJ/m²K

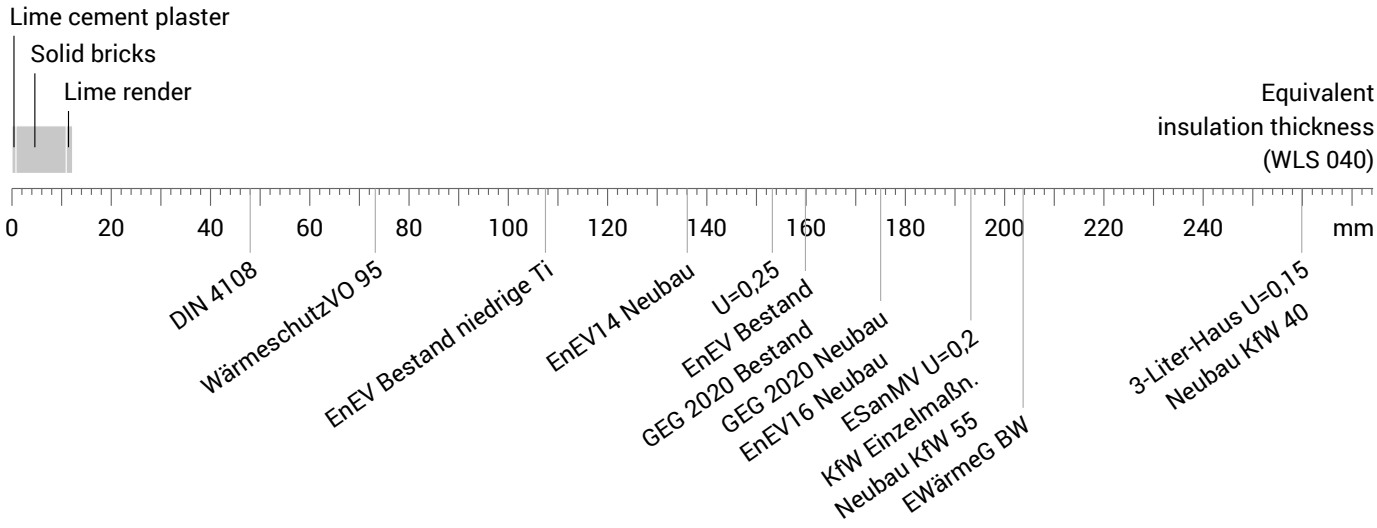
excellent insufficient



① Lime cement plaster (20 mm) ② Solid bricks (200 mm) ③ Lime render (20 mm)

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:	24,0 cm
Outside air:	-5,0°C / 80%	sd-value:	2,5 m	Weight:	464 kg/m²
Surface temperature.:	13,0°C / -2,9°C			Heat capacity:	400 kJ/m²K

*Comparison to the maximum U-value according to the german EnEV 2014/2016 for first-time installation or renewal of Außenwänden (Anlage 3, Tabelle 1, Zeile 1).

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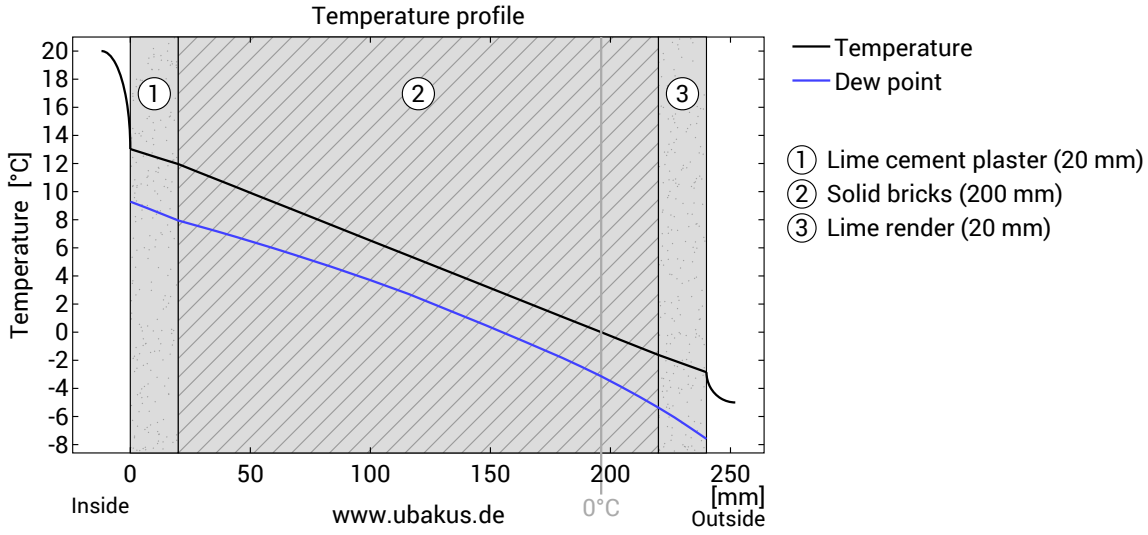
Temperature profile



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] min	Temperatur [°C] max	Weight [kg/m²]
		Thermal contact resistance*		0,130	13,0	20,0	
1	2 cm	Lime cement plaster	1,000	0,020	12,0	13,0	36,0
2	20 cm	Solid bricks	0,790	0,253	-1,6	12,0	400,0
3	2 cm	Lime render	0,870	0,023	-2,9	-1,6	28,0
		Thermal contact resistance*		0,040	-5,0	-2,9	
	24 cm	Whole component		0,466			464,0

*Assuming free circulating air at the inside surface.

Surface temperature inside (min / average / max):	13,0°C	13,0°C	13,0°C
Surface temperature outside (min / average / max):	-2,9°C	-2,9°C	-2,9°C

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Moisture proofing

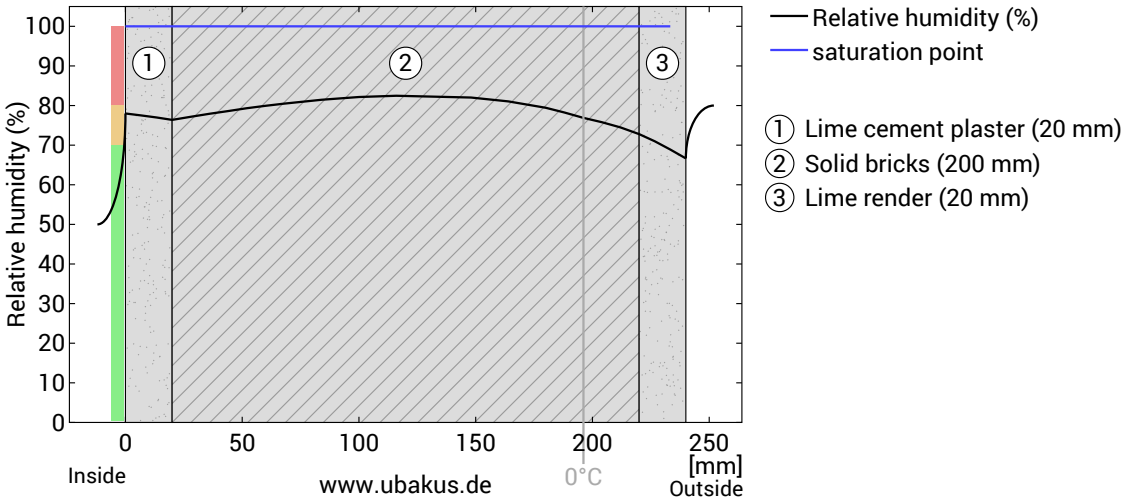
For the calculation of the amount of condensation water, the component was exposed to the following constant climate for 90 days: inside: 20°C und 50% Humidity; outside: -5°C und 80% Humidity. This climate complies with DIN 4108-3.

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

#		Material	sd-value [m]	Condensate [kg/m²]	[Gew.-%]	Weight [kg/m²]
1	2 cm	Lime cement plaster	0,30	-		36,0
2	20 cm	Solid bricks	2,00	-		400,0
3	2 cm	Lime render	0,20	-		28,0
	24 cm	Whole component	2,50			464,0

Humidity

The temperature of the inside surface is 13,0 °C leading to a relative humidity on the surface of 78%.Some kinds of mould start to grow at relative air humidities of 70% or more, mould cannot be excluded!. To avoid mould formation, the surface temperature should be increased by (additional) insulation.
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.

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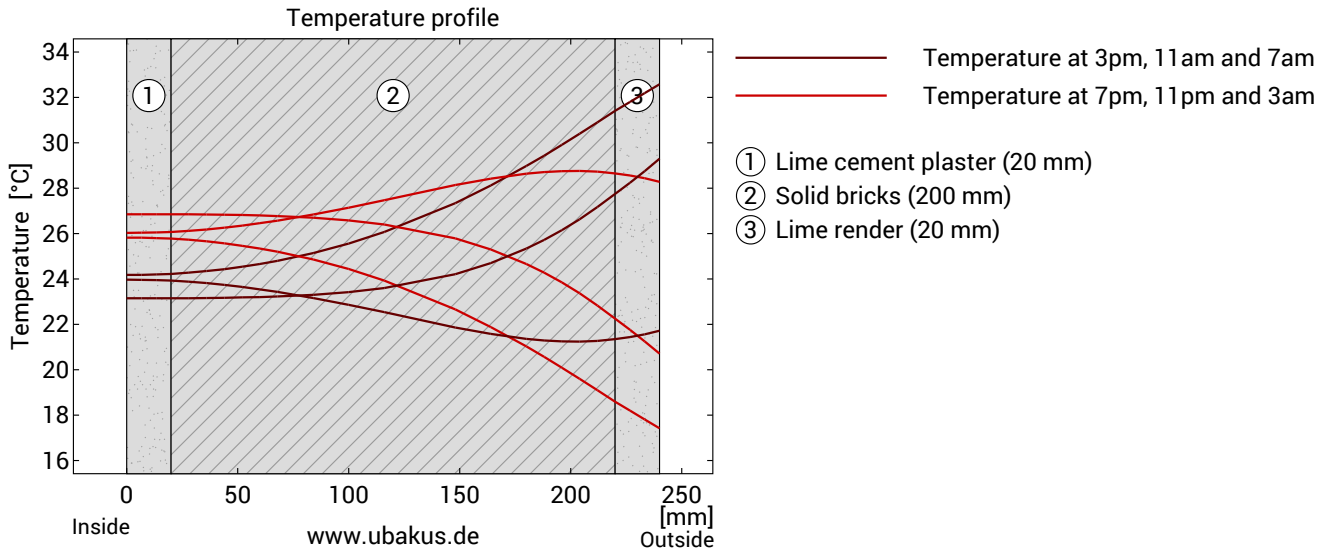
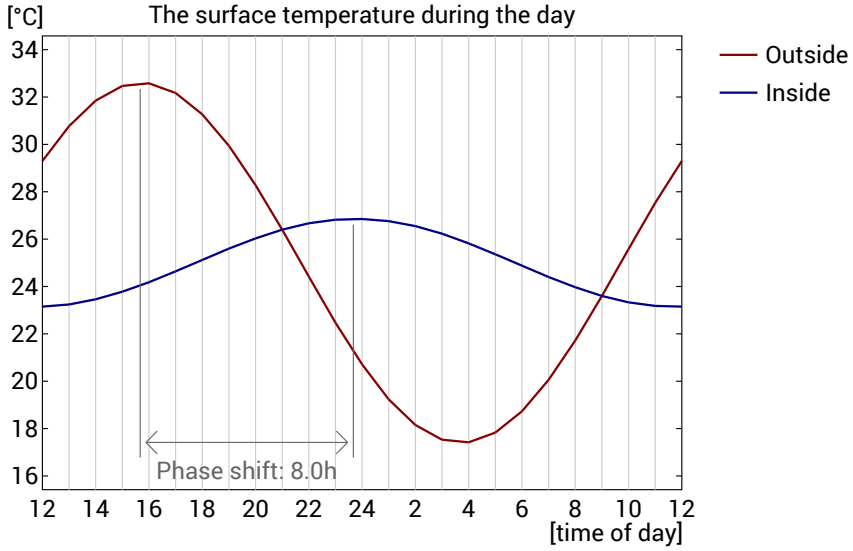
Heat protection

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*	8,0 h	Heat storage capacity (whole component):	400 kJ/m²K
Amplitude attenuation **	4,1	Thermal capacity of inner layers:	172 kJ/m²K
TAV ***	0,244		

* 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.