

Cidery Wall 2x6 with Exterior Rigid Summer Vented Inside

Exterior wall
created on 8.11.2022

Thermal protection

$U = 0,21 \text{ W}/(\text{m}^2\text{K})$

GEG 2020 Bestand*: $U < 0,24 \text{ W}/(\text{m}^2\text{K})$

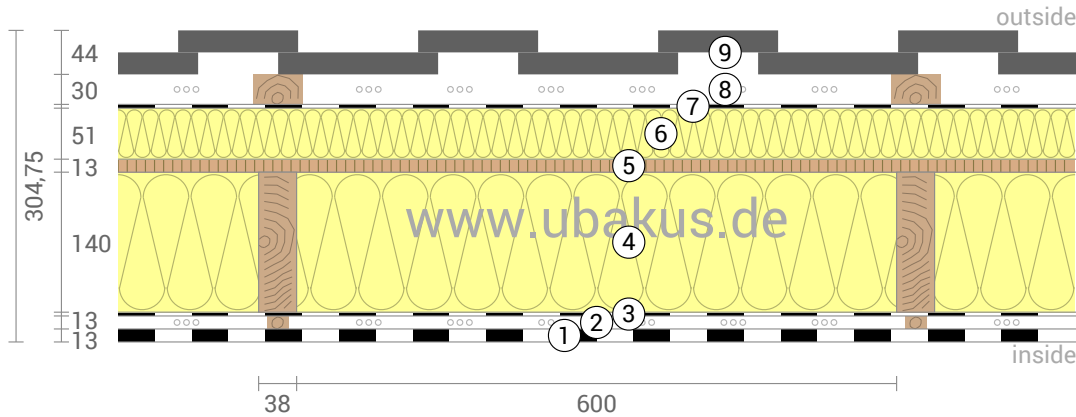


Moisture proofing

Dries 7 days
Condensate: $7,2 \text{ g}/\text{m}^2$

Heat protection

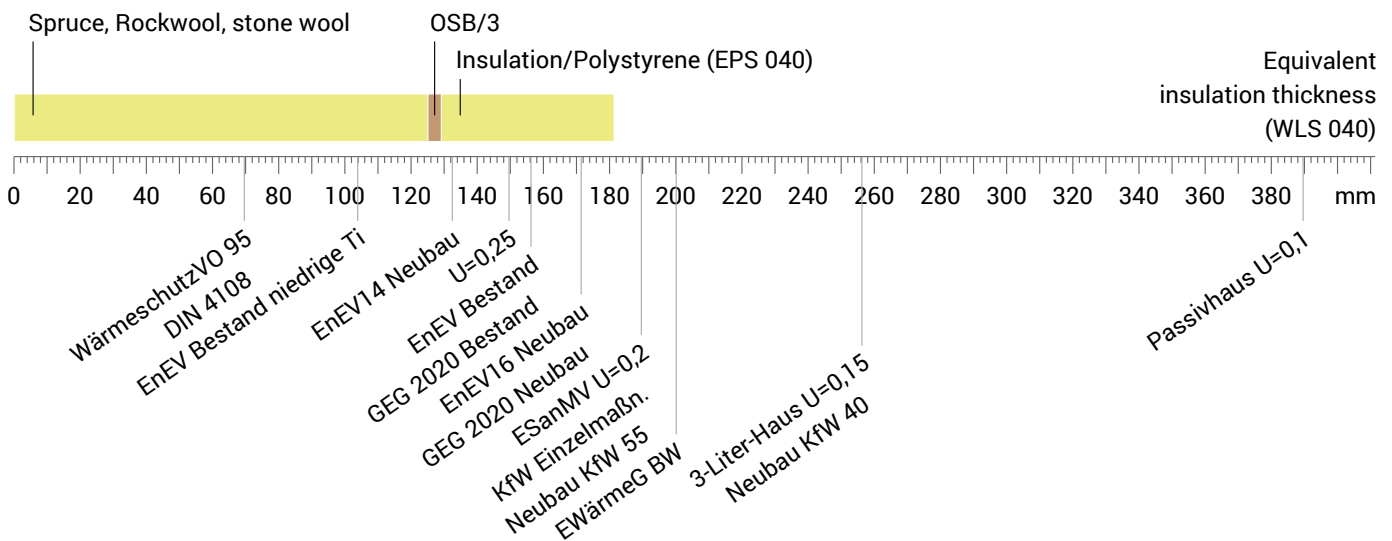
Temperature amplitude damping: 3,2
phase shift: 7,5 h
Thermal capacity inside: $13,4 \text{ kJ}/\text{m}^2\text{K}$



- ① Polyvinylchlorid
- ④ Rockwool, stone wool (140 mm)
- ⑦ Tyvek® H1
- ② Rear ventilated level (13 mm)
- ⑤ OSB/3 (13 mm)
- ⑧ Rear ventilated level (30 mm)
- ③ Foil, PE
- ⑥ Insulation/Polystyrene (51 mm)
- ⑨ Vertical cladding (44 mm)

Impact of each layer and comparison to reference values

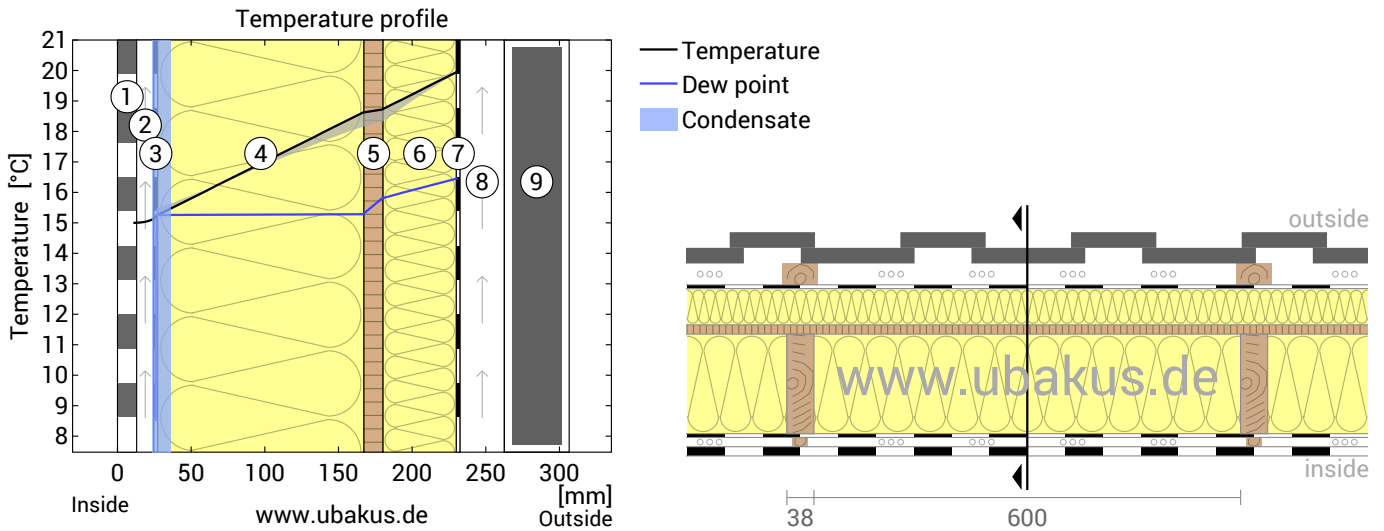
For the following figure, the thermal resistances of the individual layers were converted in millimeters insulation. The scale refers to an insulation of thermal conductivity 0,040 W/mK.



Inside air :	15,0°C / 65%		Thickness:	30,5 cm
Outside air:	20,0°C / 80%	sd-value: 69,4 m	Weight:	48 kg/m ²
Surface temperature.:	15,2°C / 20,0°C		Heat capacity:	30 kJ/m ² K

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Temperature profile



- | | | |
|---------------------------------|----------------------------------|---------------------------------|
| ① Polyvinylchlorid | ④ Rockwool, stone wool (140 mm) | ⑦ Tyvek® H1 |
| ② Rear ventilated level (13 mm) | ⑤ OSB/3 (13 mm) | ⑧ Rear ventilated level (30 mm) |
| ③ Foil, PE | ⑥ Insulation/Polystyrene (51 mm) | ⑨ Vertical cladding (44 mm) |

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 [m ² K/W]	Temperatur [°C]		Weight [kg/m ²]
				min	max	
1	1,3 cm Polyvinylchlorid (PVC)			15,0	18,1	18,1
2	1,3 cm Rear ventilated level (room air)			15,0	0,0	0,0
	Thermal contact resistance*		0,130	15,0	15,5	
3	0,06 cm Foil, PE	0,400	0,002	15,2	0,6	0,6
4	14 cm Rockwool, stone wool	0,040	3,500	15,2	7,9	7,9
	14 cm Spruce (6,0%)	0,130	1,077	15,4	3,8	3,8
5	1,3 cm OSB/3	0,130	0,100	18,2	8,1	8,1
6	5,1 cm Insulation/Polystyrene (EPS 040)	0,040	1,275	18,3	1,5	1,5
7	0,015 cm Tyvek® H1	0,230	0,001	20,0	0,1	0,1
	Thermal contact resistance*		0,130	20,0	20,0	
8	3 cm Rear ventilated level (outside air)			20,0	0,0	0,0
9	4,4 cm Vertical cladding (board on board)			20,0	7,7	7,7
30,475 cm Whole component			4,780			47,6

*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): 15,2°C 15,3°C 15,5°C
 Surface temperature outside (min / average / max): 20,0°C 20,0°C 20,0°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: 15°C und 65% Humidity; outside: 20°C und 80% Humidity (Climate according to user input).

After 90 days under the assumed climatic conditions, 0,007 kg condensate are accumulated.

#	Material	sd-value [m]	Condensate [kg/m ²] [Gew.-%]	Weight [kg/m ²]
3	0,06 cm Foil, PE	60,00	-	0,6
4	14 cm Rockwool, stone wool	0,20	0,0072	7,9
	14 cm Spruce (6,0%)	7,00	-	3,8
5	1,3 cm OSB/3	3,90	-	8,1
6	5,1 cm Insulation/Polystyrene (EPS 040)	5,10	-	1,5
7	0,015 cm Tyvek® H1	0,01	-	0,1
	30,475 cm Whole component	69,45	0,0072	47,6

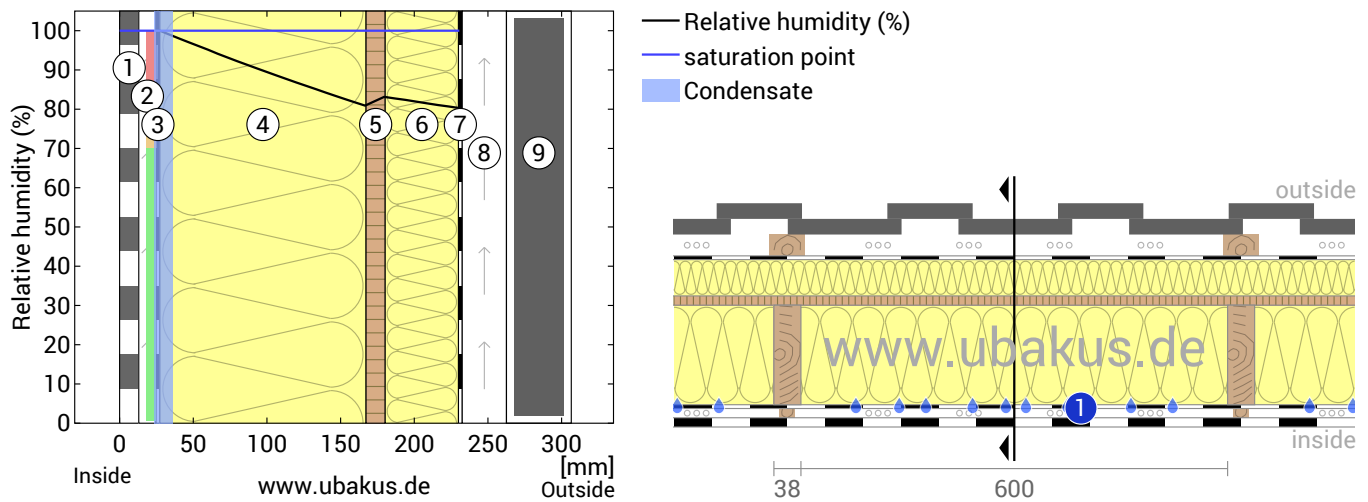
Condensation areas

- ① Condensate: 0,007 kg/m² Affected layers: Rockwool, stone wool, Foil, PE

Humidity

The temperature of the inside surface is 15,0 °C leading to a relative humidity on the surface of 64%. Mould formation is not expected under these conditions.

The following figure shows the relative humidity inside the component.



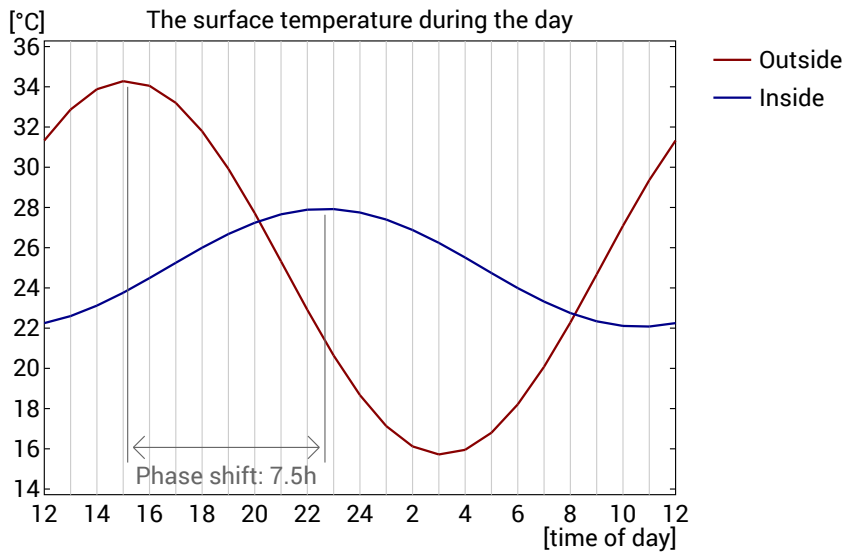
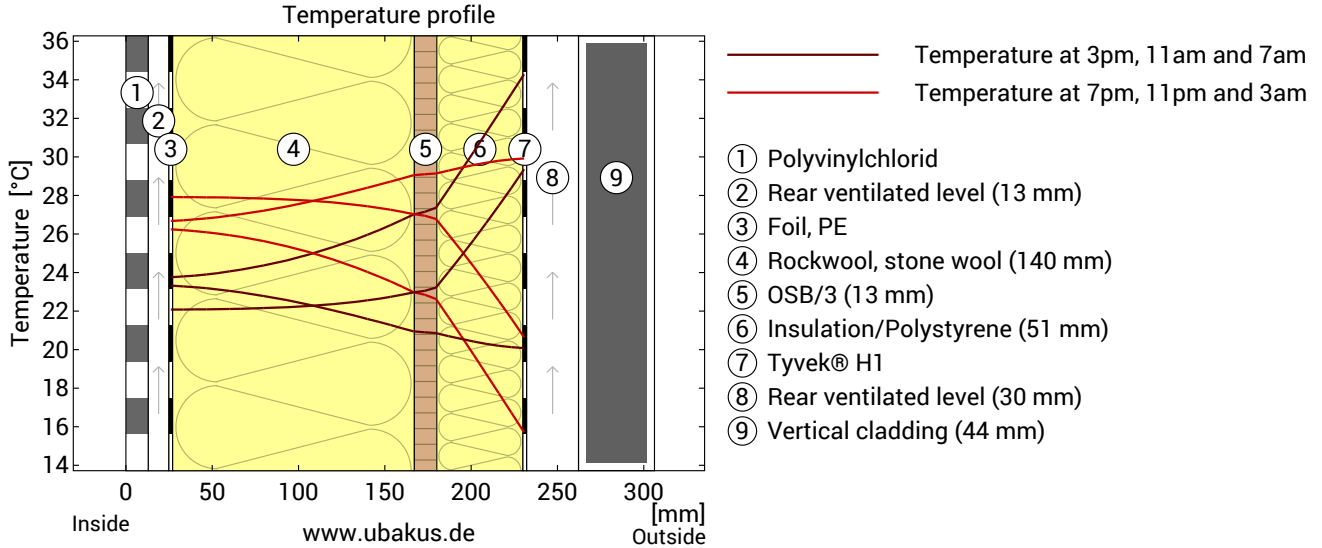
- | | | |
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Notes: Calculation using the Ubakus 2D-FE method. Convection and the capillarity of the building materials were not considered. The drying time may take longer under unfavorable conditions (shading, damp / cool summers) than calculated here.

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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*	7,5 h	Heat storage capacity (whole component):	30 kJ/m ² K
Amplitude attenuation **	3,2	Thermal capacity of inner layers:	13.4 kJ/m ² K
TAV ***	0,316		

* 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.

The calculations presented above have been created for a 1-dimensional cross-section of the component.