2025-03-15 the whole wall

Exterior wall
created on 15.3.2025

Thermal protection

U = 0,12 W/(m²K)

GEG 2020/24 Bestand*: U<0,24 W/(m²K)

excellent — insufficient

Moisture proofing

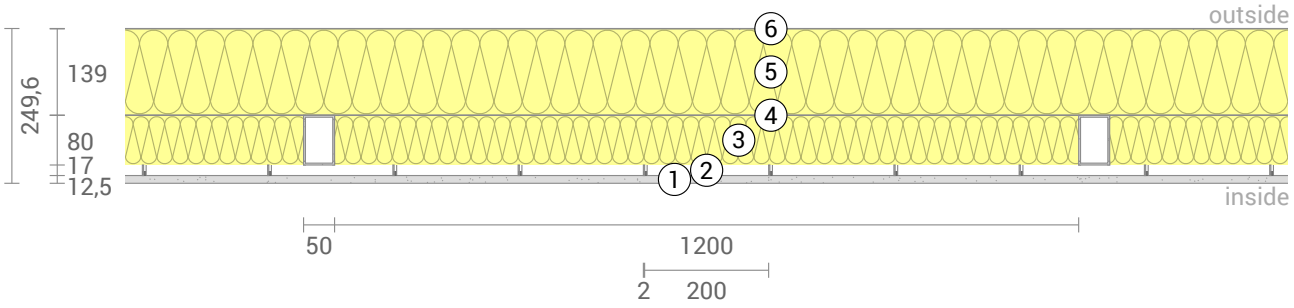
Condensate: 0,66 kg/m²
Dries 32 days

excellent — insufficient

Heat protection

Temperature amplitude damping: 8,5
phase shift: 8,8 h
Thermal capacity inside: 15,4 kJ/m²K

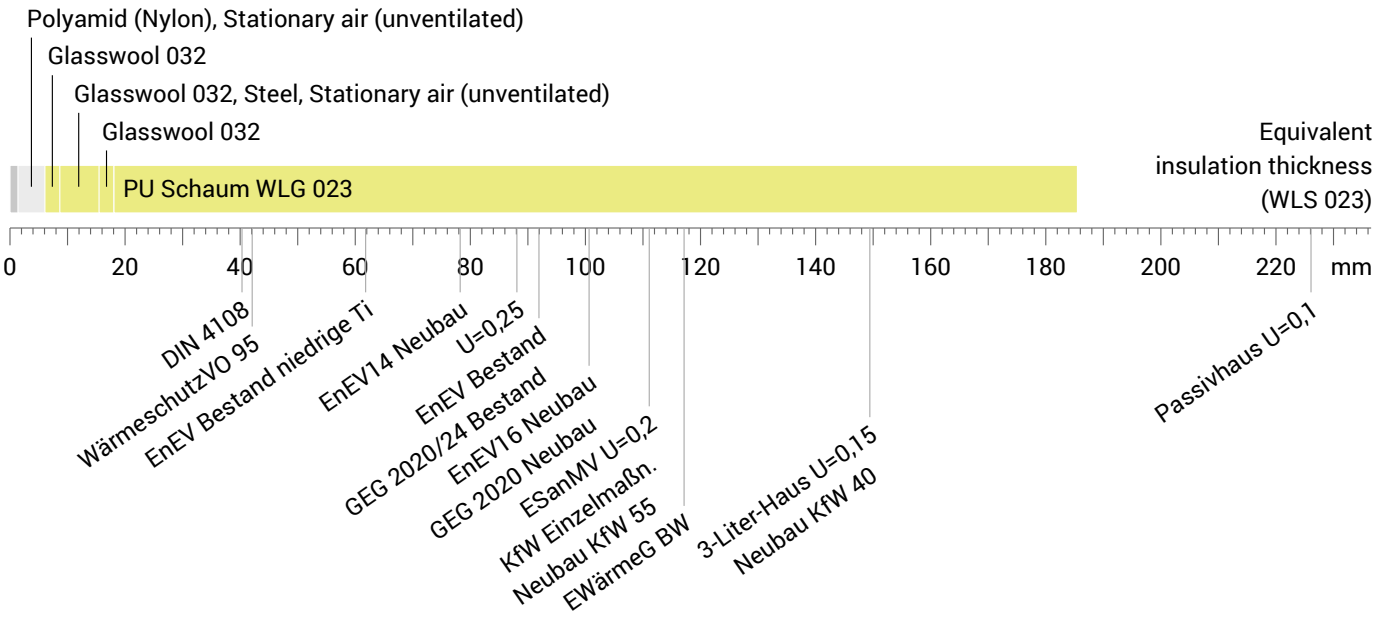
excellent — insufficient



1. Gypsum board (12,5 mm)
2. Stationary air (17 mm)
3. Glasswool 032 (80 mm)
4. Steel (0,5 mm)
5. PU Schaum WLG 023 (139 mm)
6. Steel (0,6 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 0,023 W/mK.



Inside air :	22,0°C / 50%			Thickness:	25,0 cm
Outside air:	-20,0°C / 80%		sd-value: 142110,7 m	Weight:	29 kg/m²
Surface temperature.:	19,8°C / -19,8°C			Heat capacity:	22 kJ/m²K

*Vergleich mit dem Höchstwert gemäß GEG 2020-2024 für erstmaligen Einbau, Ersatz oder Erneuerung von Außenwänden (Anlage 7, Zeile 1a,1b).

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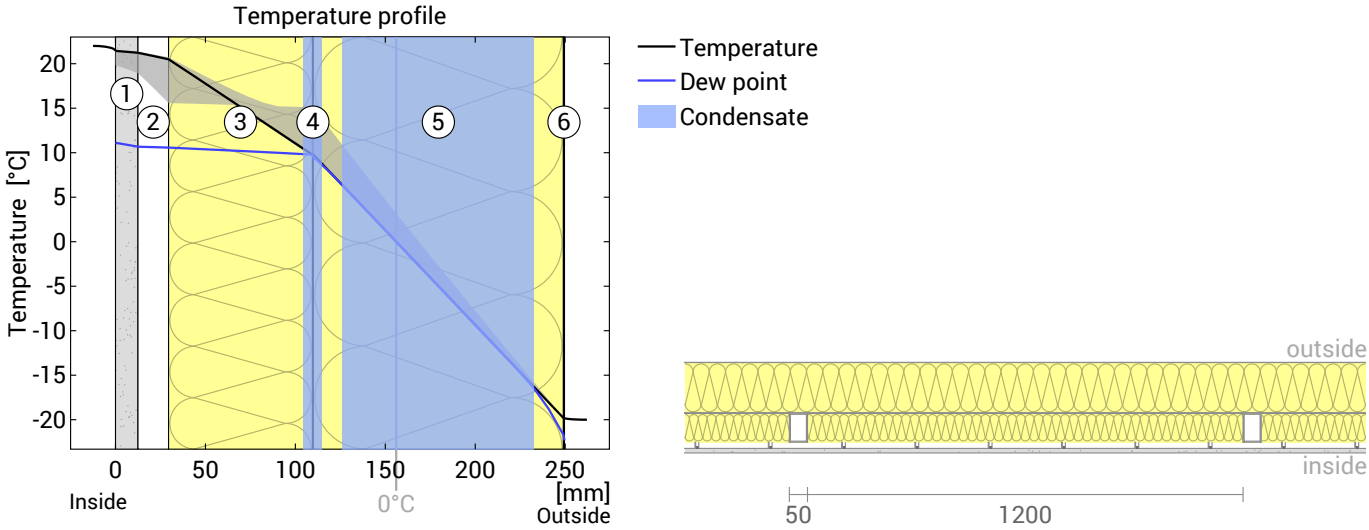
Temperature profile



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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	Temperatur [°C] max	Weight [kg/m²]
		Thermal contact resistance*		0,130	19,8	22,0	
1	1,25 cm	Gypsum board	0,250	0,050	18,9	21,5	8,5
2	1,7 cm	Stationary air (unventilated)	0,099	0,172	15,6	21,3	0,0
	1,7 cm	Polyamid (Nylon) (0,99%)	0,250	0,068	20,5	21,2	0,2
3	8 cm	Glasswool 032	0,032	2,500	9,5	20,7	2,3
	8 cm	Steel (0,24%)	50,000	0,002	15,1	15,6	1,5
	8 cm	Steel (0,24%)	50,000	0,002	15,1	15,6	1,5
	0,3 cm	Steel (Width: 5 cm)	50,000	0,000	15,1	15,1	1,0
	0,3 cm	Steel (Width: 5 cm)	50,000	0,000	15,6	15,6	1,0
	7,4 cm	Stationary air (unventilated) (Width: 4,4 cm)	0,411	0,180	15,1	15,6	0,0
4	0,05 cm	Steel	50,000	0,000	9,5	15,1	3,9
5	13,9 cm	PU Schaum WLG 023	0,023	6,043	-19,8	15,1	4,2
6	0,06 cm	Steel	50,000	0,000	-19,8	-19,8	4,7
		Thermal contact resistance*		0,040	-20,0	-19,8	
	24,96 cm	Whole component		8,221			28,7

*Assuming free circulating air at the inside surface.

Surface temperature inside (min / average / max):	19,8°C	21,3°C	21,5°C
Surface temperature outside (min / average / max):	-19,8°C	-19,8°C	-19,8°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: 22°C und 50% Humidity; outside: -20°C und 80% Humidity (Climate according to user input).

Interior heat transfer resistance Rsi (user input deviating from DIN 4108-3):0.13 m²K/W

Under these conditions, a total of 0,66 kg of condensation water per square meter is accumulated.This quantity dries in summer in 32 days (Drying season according to DIN 4108-3:2018-10).

#		Material	sd-value [m]	Condensate [kg/m²]	[Gew.-%]	Weight [kg/m²]
1	1,25 cm	Gypsum board	0,05	-		8,5
2	1,7 cm	Stationary air (unventilated)	0,01	-		0,0
	1,7 cm	Polyamid (Nylon) (0,99%)	850,00	-		0,2
3	8 cm	Glasswool 032	0,08	0,66		2,3
	8 cm	Steel (0,24%)	1500	-		1,5
	8 cm	Steel (0,24%)	1500	-		1,5
	0,3 cm	Steel (Width: 5 cm)	1500	-		1,0
	0,3 cm	Steel (Width: 5 cm)	1500	-		1,0
	7,4 cm	Stationary air (unventilated) (Width: 4,4 cm)	0,01	-		0,0
4	0,05 cm	Steel	1500	-		3,9
5	13,9 cm	PU Schaum WLG 023	139000	-		4,2
6	0,06 cm	Steel	1500	-		4,7
	24,96 cm	Whole component	142.110,70	0,66		28,7

Condensation areas

1. Condensate: 0,17 kg/m² Affected layers: Steel, Glasswool 032
2. Condensate: 0,33 kg/m² Affected layers: Steel, Glasswool 032
3. Condensate: 0,16 kg/m² Affected layers: Steel, Glasswool 032
4. Condensate: ~0 kg/m² Affected layers: PU Schaum WLG 023

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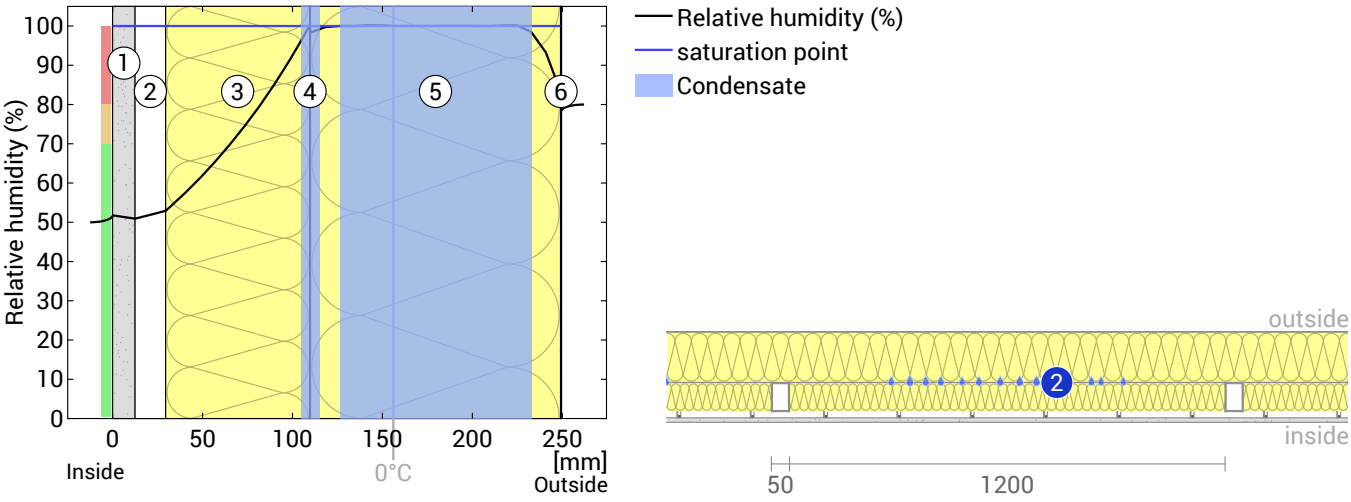
Humidity

The temperature of the inside surface is 19,8 °C leading to a relative humidity on the surface of 57%.Mould formation is not expected under these conditions.
The following figure shows the relative humidity inside the component.



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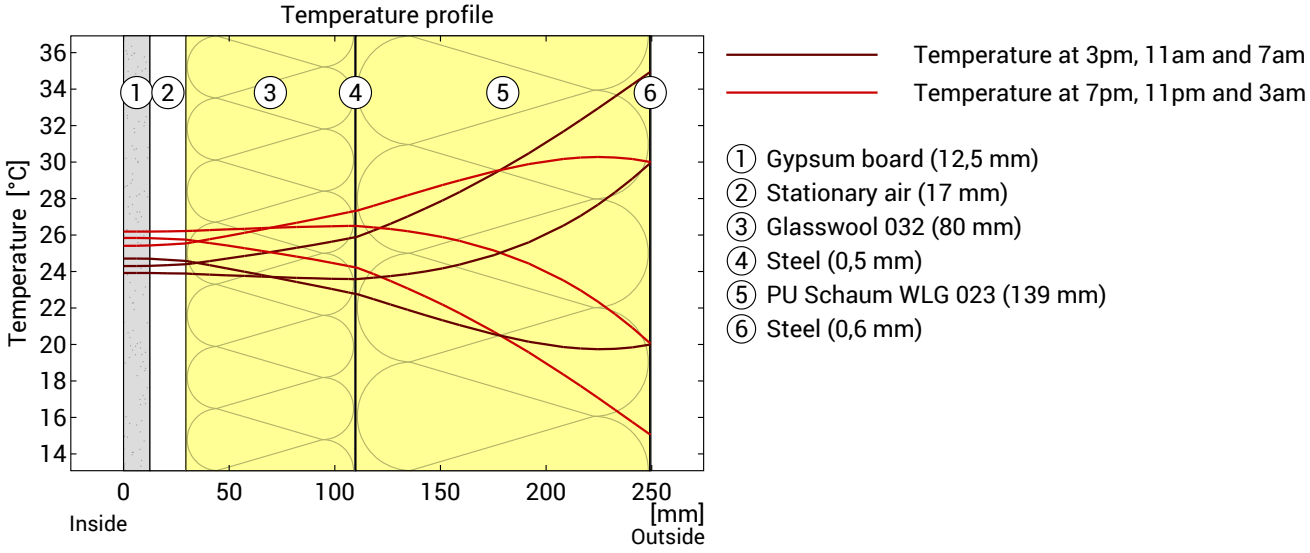
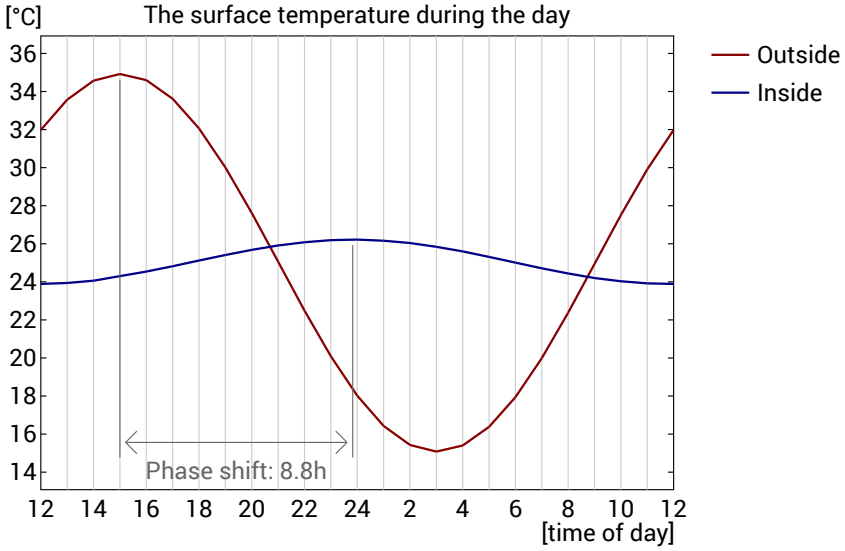
Notes: Calculation using the Ubakus 2D-FE method. Convection and the capillarity of the building materials were not considered. The drying time may take longer under unfavorable conditions (shading, damp / cool summers) than calculated here.

2025-03-15 the whole wall, U=0,12 W/(m²K)

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*	8,8 h	Heat storage capacity (whole component):	22 kJ/m²K
Amplitude attenuation **	8,5	Thermal capacity of inner layers:	15.4 kJ/m²K
TAV ***	0,117		

* 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.