

Tallinn. KL-1.

Flat roof

Raamtingimused, mis on arvesse võetud arvutuste tegemiseks on järgmised (DIN EN ISO 6946-7 järgi):

Kondenseerumisperioodil (tT): väliskliima $-10\text{ }^{\circ}\text{C}$, 80% rel. niiskus; sisekliima $+20\text{ }^{\circ}\text{C}$, 50% rel. niiskus; perioodi pikkus 2160 h (90 päeva).

Aurumisperioodil tV : väliskliima $+12\text{ }^{\circ}\text{C}$, 70% rel. niiskus; sisekliima $+12\text{ }^{\circ}\text{C}$, 70% rel. niiskus; kliima kondenseerumiskohas $+12\text{ }^{\circ}\text{C}$, 100% rel. niiskust; perioodi pikkus 2160 h ehk 90 päeva.

Thermal protection

$U = 0,10\text{ W}/(\text{m}^2\text{K})$

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



Moisture proofing

Dries 91 days

Condensate: $79\text{ g}/\text{m}^2$

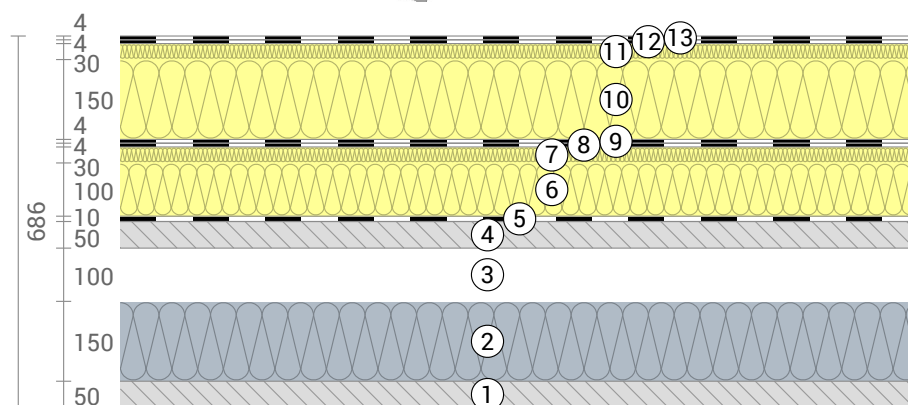
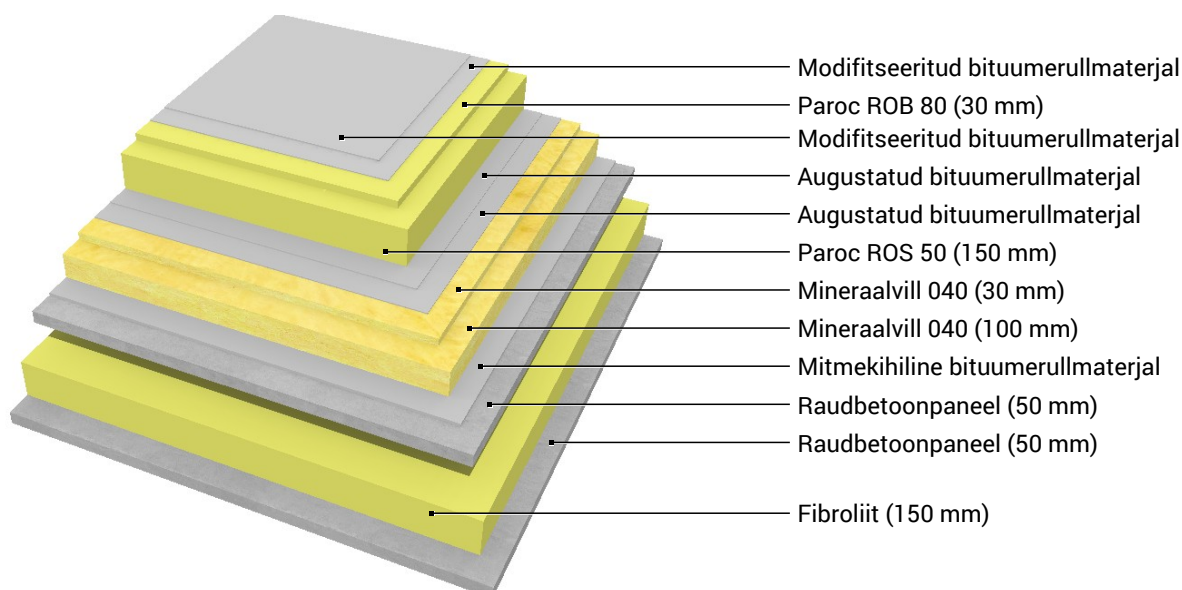


Heat protection

Temperature amplitude damping: >100

phase shift: non relevant

Thermal capacity inside: $338\text{ kJ}/\text{m}^2\text{K}$



- | | |
|-------------------------------------|---------------------------------------|
| ① Raudbetoonpaneel (50 mm) | ⑧ Augustatud bituumerullmaterjal |
| ② Fibrolit (150 mm) | ⑨ Augustatud bituumerullmaterjal |
| ③ Õhkvahe (100 mm) | ⑩ Paroc ROS 50 (150 mm) |
| ④ Raudbetoonpaneel (50 mm) | ⑪ Paroc ROB 80 (30 mm) |
| ⑤ Mitmekihiline bituumerullmaterjal | ⑫ Modifitseeritud bituumerullmaterjal |
| ⑥ Mineraalvill 040 (100 mm) | ⑬ Modifitseeritud bituumerullmaterjal |
| ⑦ Mineraalvill 040 (30 mm) | |

Tallinn. KL-1., U=0,10 W/(m²K)

Inside air : 20,0°C / 50%

Thickness: 68,6 cm

Outside air: -10,0°C / 80%

sd-value: 177,6 m

Weight: 383 kg/m²

Surface temperature.: 19,2°C / -9,9°C

Heat capacity: 436 kJ/m²K

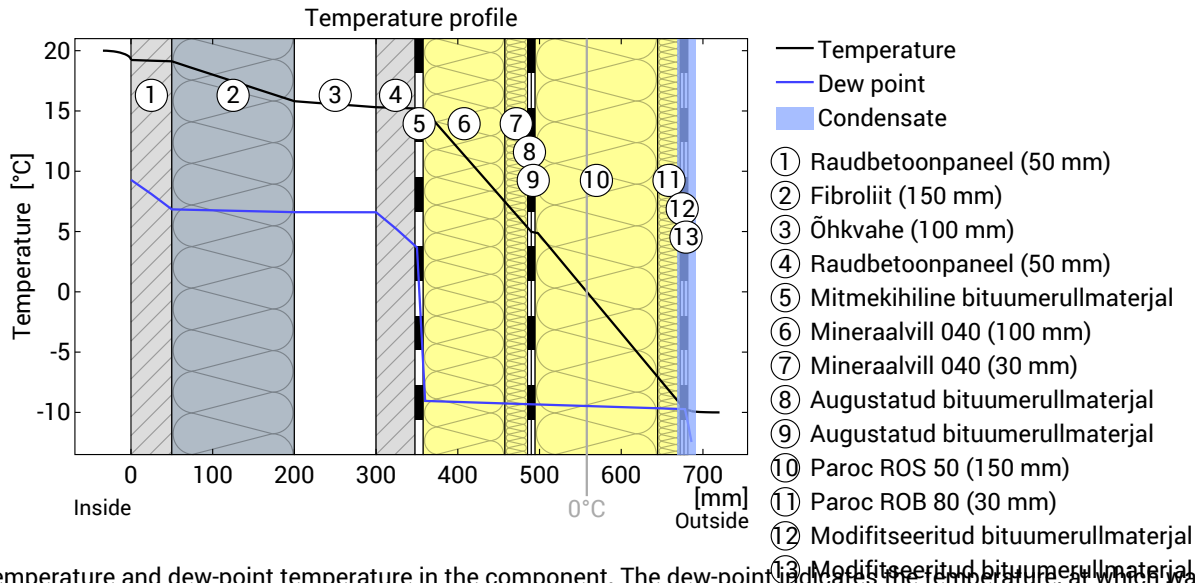
☒ EnEV Bestand

☒ BEG Einzelmaßn.

☒ GEG 2020 Bestand

☒ GEG 2020 Neubau

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*		0,100	19,2	20,0	
1	5 cm Raudbetoonpaneel	1,400	0,036	19,1	19,2	120,0
2	15 cm Fibrolit	0,140	1,071	15,8	19,1	52,1
3	10 cm Õhkvahe (mitte ventileeritud)	0,625	0,160	15,3	15,8	0,1
4	5 cm Raudbetoonpaneel	1,400	0,036	15,2	15,3	120,0
5	1 cm Mitmekihiline bituumerullmaterjal	0,170	0,059	15,0	15,2	9,8
6	10 cm Mineraalvill 040	0,040	2,500	7,3	15,0	1,5
7	3 cm Mineraalvill 040	0,040	0,750	5,0	7,3	0,5
8	0,4 cm Augustatud bituumerullmaterjal	0,230	0,017	4,9	5,0	4,4
9	0,4 cm Augustatud bituumerullmaterjal	0,230	0,017	4,9	4,9	4,4
10	15 cm Paroc ROS 50	0,038	3,947	-7,3	4,9	19,5
11	3 cm Paroc ROB 80	0,038	0,789	-9,8	-7,3	42,0
12	0,4 cm Modifitseeritud bituumerullmaterjal	0,230	0,017	-9,8	-9,8	4,4
13	0,4 cm Modifitseeritud bituumerullmaterjal	0,230	0,017	-9,9	-9,8	4,4
	Thermal contact resistance*		0,040	-10,0	-9,9	
	68,6 cm Whole component		9,558			383,0

*Thermal contact resistances according to DIN 6946 for the U-value calculation. Rsi=0,25 and Rse=0,04 according to DIN 4108-3 were used for moisture proofing and temperature profile.

Surface temperature inside (min / average / max): 19,2°C 19,2°C 19,2°C
 Surface temperature outside (min / average / max): -9,9°C -9,9°C -9,9°C

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 80% Humidity (Climate according to user input).

Under these conditions, a total of 0,079 kg of condensation water per square meter is accumulated. This amount would require 91 days to dry in the summer (Drying season according to DIN 4108-3:2018-10). This is more than the 90 days permitted by the DIN 4108-3, and it must be expected that the component does not dry out completely in the warm season!

#	Material	sd-value [m]	Condensate [kg/m²] [Gew.-%]	Weight [kg/m²]
1	5 cm Raudbetoonpaneel	3,50	-	120,0
2	15 cm Fibrolit	0,30	-	52,1
3	10 cm Õhkvahe (mitte ventileeritud)	0,01	-	0,1
4	5 cm Raudbetoonpaneel	3,50	-	120,0
5	1 cm Mitmekihiline bituumerullmaterjal	10,00	-	9,8
6	10 cm Mineraalvill 040	0,10	-	1,5
7	3 cm Mineraalvill 040	0,03	-	0,5
8	0,4 cm Augustatud bituumerullmaterjal	0,00	-	4,4
9	0,4 cm Augustatud bituumerullmaterjal	0,00	-	4,4
10	15 cm Paroc ROS 50	0,15	-	19,5
11	3 cm Paroc ROB 80	0,03	0,079	42,0
12	0,4 cm Modifitseeritud bituumerullmaterjal	80,00	-	4,4
13	0,4 cm Modifitseeritud bituumerullmaterjal	80,00	-	4,4
68,6 cm Whole component		177,63	0,079	383,0

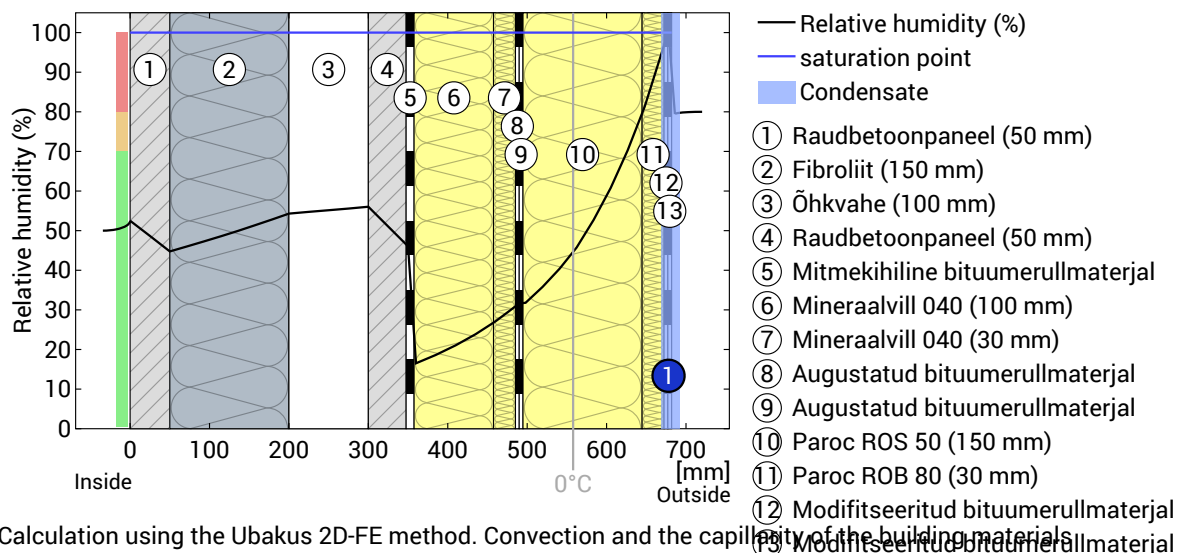
Condensation areas

- ① Condensate: 0,079 kg/m² Affected layers: Modifitseeritud bituumerullmaterjal, Paroc ROB 80

Humidity

The temperature of the inside surface is 19,2 °C leading to a relative humidity on the surface of 53%. 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.