

Steco STANDARD Flat roof V20

Flat roof
created on 23.1.2018

Thermal protection

$U = 0,129 \text{ W}/(\text{m}^2\text{K})$

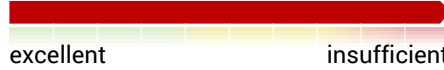
EnEV Bestand*: $U < 0,2 \text{ W}/(\text{m}^2\text{K})$



Moisture proofing

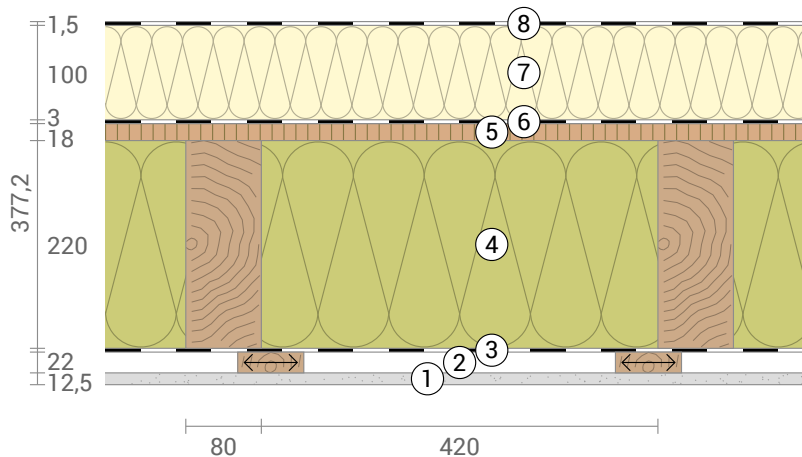
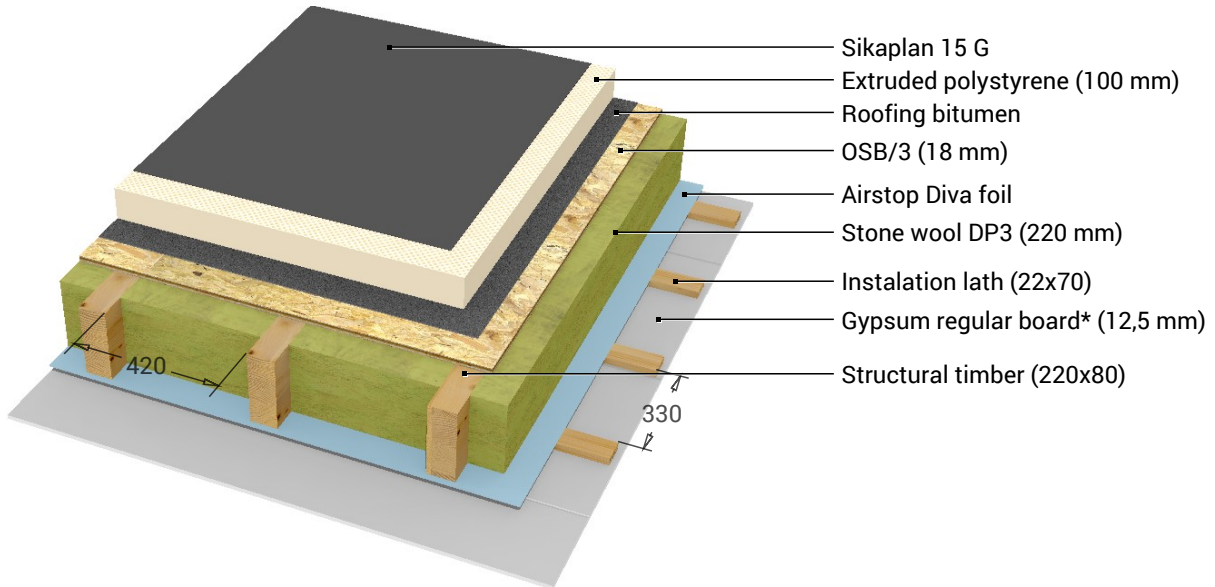
Drying reserve: $35 \text{ g}/\text{m}^2\text{a}$
(leads to a worse rating)

$\downarrow 26 \text{ g}/\text{m}^2$ $\uparrow \approx 33 \text{ Days}$ $\uparrow +0,2\%$



Heat protection

Temperature amplitude damping: 27
phase shift: 12,5 h
Thermal capacity inside: $39 \text{ kJ}/\text{m}^2\text{K}$



- | | | |
|-----------------------------------|---------------------------|---------------------------------|
| ① Gypsum regular board* (12,5 mm) | ④ Stone wool DP3 (220 mm) | ⑦ Extruded polystyrene (100 mm) |
| ② Instalation gap (22 mm) | ⑤ OSB/3 (18 mm) | ⑧ Sikaplan 15 G |
| ③ Airstop Diva foil | ⑥ Roofing bitumen | |

<-> The (beam) positions marked with arrows are perpendicular to the main axis.

Inside air : $20,0^\circ\text{C} / 50\%$
Outside air: $-5,0^\circ\text{C} / 80\%$
Surface temperature.: $18,9^\circ\text{C} / -4,9^\circ\text{C}$

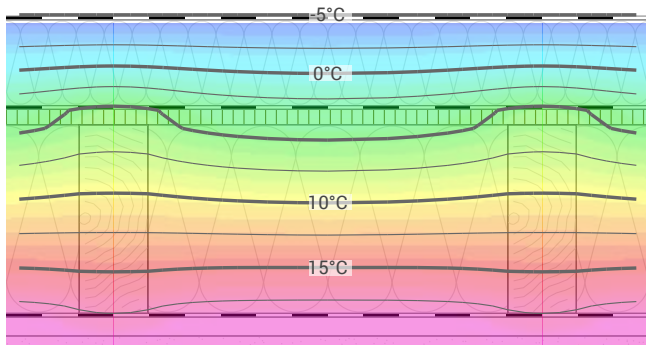
sd-value: $230,5 \text{ m}$
Drying reserve: $35 \text{ g}/\text{m}^2\text{a}$

Thickness: $37,7 \text{ cm}$
Weight: $49 \text{ kg}/\text{m}^2$
Heat capacity: $68 \text{ kJ}/\text{m}^2\text{K}$

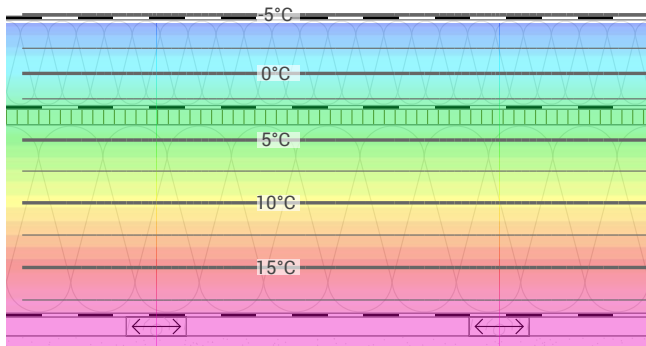
EnEV Bestand EnEV16 Neubau EnEV14 Neubau EnEV Bestand (Nichtwohngeb.)

Steco STANDARD Flat roof V20, U=0,13 W/(m²K)

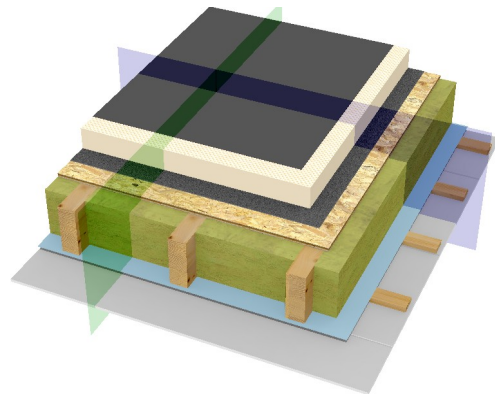
Temperature profile



80 420



70 330



Top left: Temperature profile in the blue section (see right illustration). Bottom left: Temperature profile in the green section.

Layers (from inside to outside)

#	Material	λ [W/mK]	R [m ² K/W]	Temperatur [°C]		Weight [kg/m ²]
				min	max	
	Thermal contact resistance*		0,100	18,9	20,0	
1	1,25 cm Gypsum regular board*	0,250	0,050	18,7	19,3	8,5
2	2,2 cm Instalation gap	0,138	0,160	17,8	19,2	0,0
	2,2 cm Instalation lath (18%)	0,130	0,169			0,0
3	0,02 cm Airstop Diva foil	0,500	0,000	17,8	18,8	0,1
4	22 cm Stone wool DP3	0,039	5,641	4,1	18,8	5,5
	22 cm Structural timber (16%)	0,130	1,692	6,1	18,1	15,8
5	1,8 cm OSB/3	0,130	0,138	3,7	6,2	11,2
6	0,3 cm Roofing bitumen	0,230	0,013	3,7	5,5	3,3
7	10 cm Extruded polystyrene (XPS 035)	0,035	2,857	-4,9	5,4	3,5
8	0,15 cm Sikaplan 15 G	0,250	0,006	-4,9	-4,8	1,8
	Thermal contact resistance*		0,040	-5,0	-4,9	
	37,72 cm Whole component		7,644			49,8

*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): 18,9°C 19,2°C 19,3°C
Surface temperature outside (min / average / max): -4,9°C -4,9°C -4,9°C

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Moisture proofing

During the winter season of 90 days, a total of 0,026 kg of condensation water per square meter is generated. This quantity dries in summer in 33 days (Drying season according to DIN 4108-3:2014-11).

The drying reserve of this component is 35 g/(m²a). Required by DIN 68800-2: at least 250 g/(m²a).

The moisture protection of this component is therefore assessed as inadequate.

#	Material	sd-value [m]	Condensate		Weight [kg/m ²]
			[kg/m ²]	[Gew.-%]	
1	1,25 cm Gypsum regular board*	0,05	-		8,5
2	2,2 cm Instalation gap	0,01	-		0,0
	2,2 cm Instalation lath (18%)		-	-	0,0
3	0,02 cm Airstop Diva foil	18,00	-		0,1
4	22 cm Stone wool DP3	0,22	0,022		5,5
	22 cm Structural timber (16%)	4,40	-	-	15,8
5	1,8 cm OSB/3	2,70	0,026	0,2	11,2
6	0,3 cm Roofing bitumen	150,00	-		3,3
7	10 cm Extruded polystyrene (XPS 035)	20,00	~0		3,5
8	0,15 cm Sikaplan 15 G	39,00	-		1,8
	37,72 cm Whole component	230,49	0,026		49,8

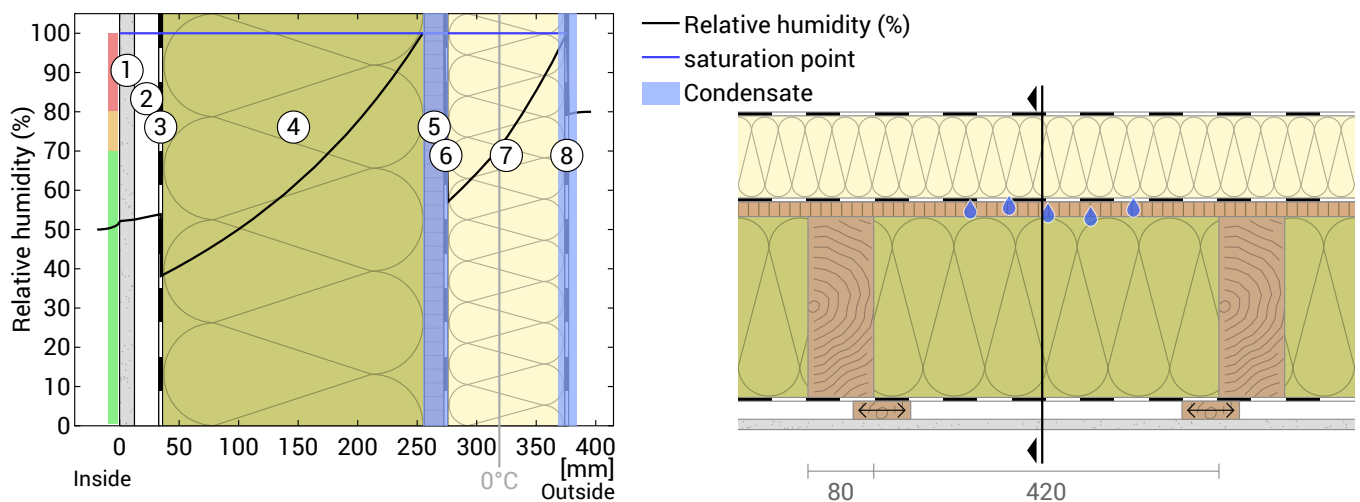
Condensation areas

- ① Condensate: 0,026 kg/m² Drying time: 33 Days Affected layers: OSB/3, Stone wool DP3, Roofing bitumen
- ② Condensate: ~0 kg/m² Affected layers: Sikaplan 15 G, Extruded polystyrene (XPS 035)

Humidity

The temperature of the inside surface is 18,9 °C leading to a relative humidity on the surface of 54%. Mould formation is not expected under these conditions.

The following figure show the relative humidity inside the component.



- | | | |
|-----------------------------------|---------------------------|---------------------------------|
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| ② Instalation gap (22 mm) | ⑤ OSB/3 (18 mm) | ⑧ Sikaplan 15 G |
| ③ Airstop Diva foil | ⑥ Roofing bitumen | |

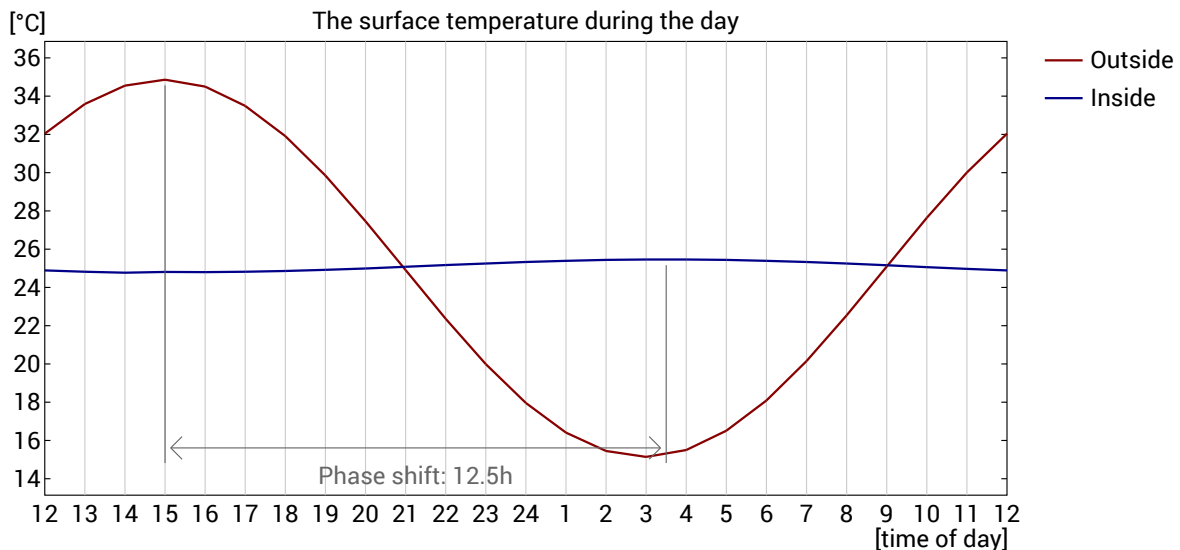
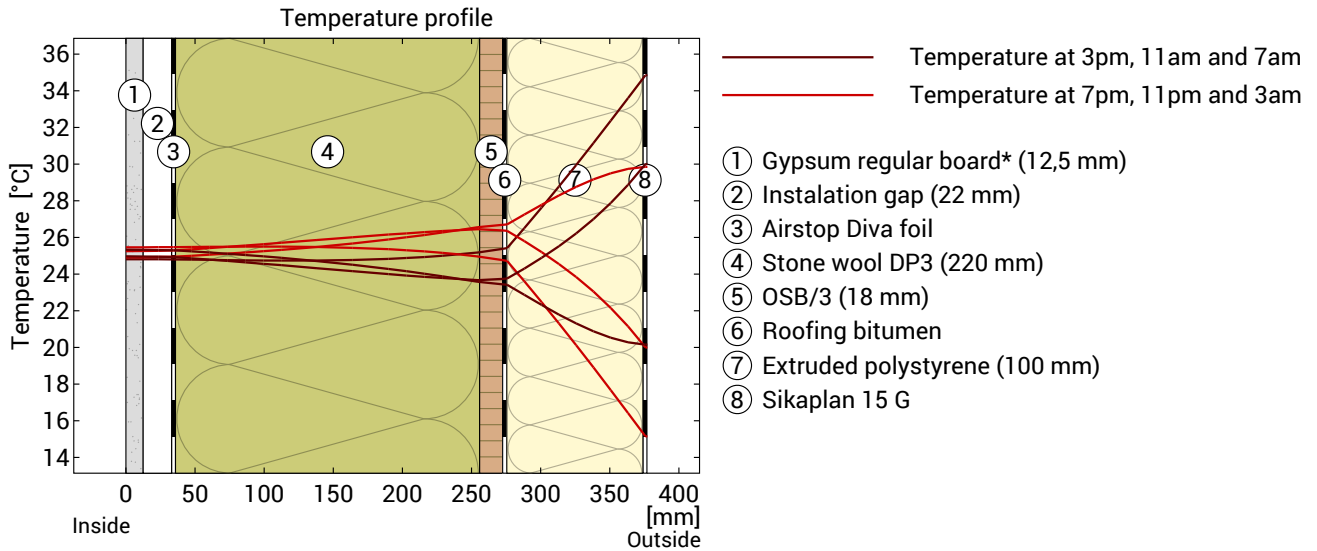
To calculate the diffusion currents a two-dimensional finite element method was used. More information on the section 'humidity' on the input form.

Layers marked with <-> run parallel to the illustrated cutting plane and were not taken into account in the moisture protection calculation.

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Heat protection

For the analysis of the heat protection, the temperature changes within the component were simulated during a hot summer day:



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*	12,5 h	Time of maximum interior temperature	3:30
Amplitude attenuation **	27,2	Thermal fluctuation on exterior surface:	19,7°C
TAV ***	0,037	Temperature fluctuation on interior surface	0,7°C

* 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

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