# 240 mm JOIST + 60 mm + vakolat, belül 50 mm installal

Exterior wall
created on 28.7.2024

Steico 240mm-es váz, farost kitöltéssel, kívül és belül kemény táblás Steico szigeteléssel

## Thermal protection

U = 0,11 W/(m²K)

DIN 4108*: R>1,75 m²K/W + $R_{si}$ + $R_{se}$

excellent insufficient

## Moisture proofing

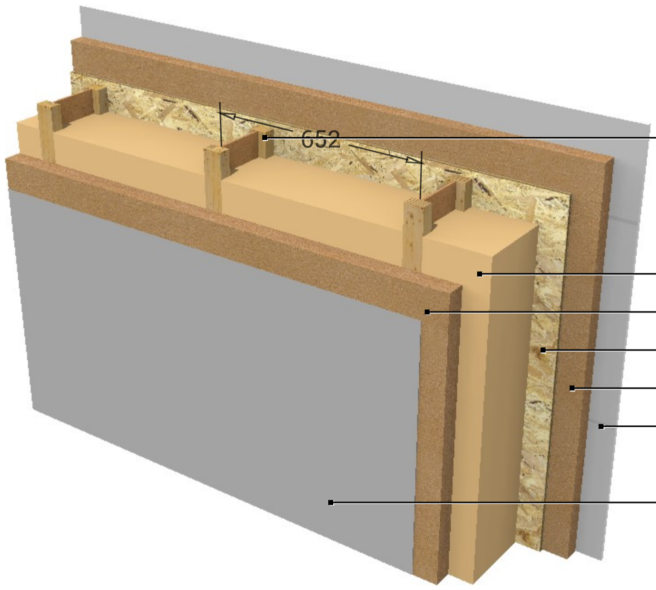
Drying reserve: 2899 g/m²a
No condensate

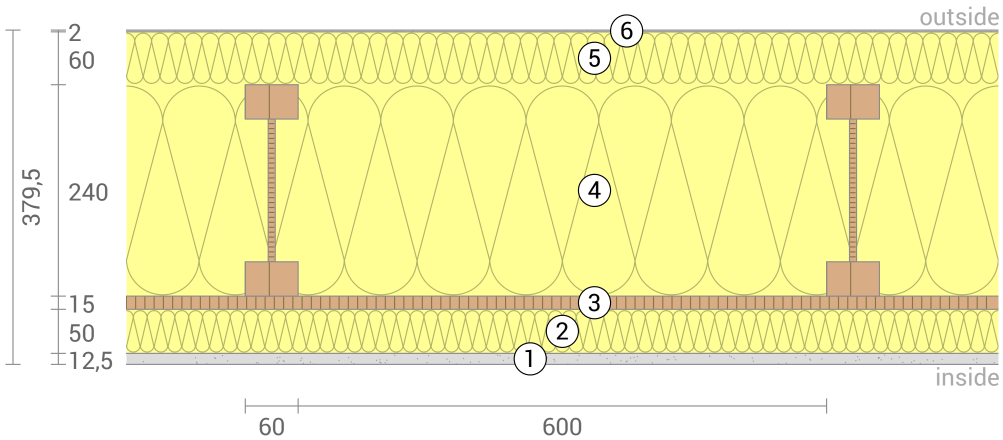
excellent insufficient

## Heat protection

Temperature amplitude damping: 81
phase shift: 17,3 h
Thermal capacity inside: 51 kJ/m²K

excellent insufficient




1. Tűzálló gipszkarton (12,5 mm)
2. STEICO install, kábelek és csövek vezetéséhez (50 mm)
3. OSB/3 (15 mm)
4. STEICO fújt farost szigetelés (240 mm)
5. STEICOprotect M dry keménytáblás farost lap (60 mm)
6. STO szilikát vakolatrendszer (2 mm)

| | | | | | |
|---|---|---|---|---|---|
| Inside air : | 22,0°C / 50% | | | Thickness: | 38,0 cm |
| Outside air: | -5,0°C / 80% | sd-value: | 3,2 m | Weight: | 52 kg/m² |
| Surface temperature.: | 21,2°C / -4,9°C | Drying reserve: | 2899 g/m²a | Heat capacity: | 88 kJ/m²K |

☑ BEG Einzelmaßn. ☑ GEG 2020/24 Bestand ☑ GEG 2023/24 Neubau ☑ DIN 4108

*Comparison of the U-value with den techn. Mindestanforderungen für BEG Einzelmaßnahmen; den Höchstwerten aus GEG Anlage 7 (GEG 2020-2024 Bestand); 70% des U-Werts der Referenzausführung aus GEG 2023/2024 Anlage 1 (GEG Neubau); den R-Werten aus DIN 4108-2 Tabelle 3



Click here to edit the construction on www.ubakus.de.

240 mm JOIST + 60 mm + vakolat, belül 50 mm installal, U=0,11 W/(m²K)

# U-Value calculation according to DIN EN ISO 6946

| # | Material | Dicke [cm] | λ [W/mK] | R [m²K/W] |
|---|---|---|---|---|
| | Thermal contact resistance inside (Rsi) | | | 0,130 |
| 1 | Tűzálló gipszkarton | 1,25 | 0,250 | 0,050 |
| 2 | STEICO install, kábelek és csövek vezetéséhez | 5,00 | 0,040 | 1,250 |
| 3 | OSB/3 | 1,50 | 0,130 | 0,115 |
| 4 | STEICO fújt farost szigetelés | 24,00 | 0,038 | 6,316 |
| | Hartfasersteg (Width: 0,8 cm) | 16,20 | 0,308 | 0,526 |
| | Furnierschichtholzgurt (Width: 6 cm) | 3,90 | 0,130 | 0,300 |
| | Furnierschichtholzgurt (Width: 6 cm) | 3,90 | 0,130 | 0,300 |
| 5 | STEICOprotect M dry keménytáblás farost lap | 6,00 | 0,040 | 1,500 |
| 6 | STO szilikát vakolatrendszer | 0,20 | 0,700 | 0,003 |
| | Thermal contact resistance outside (Rse) | | | 0,040 |

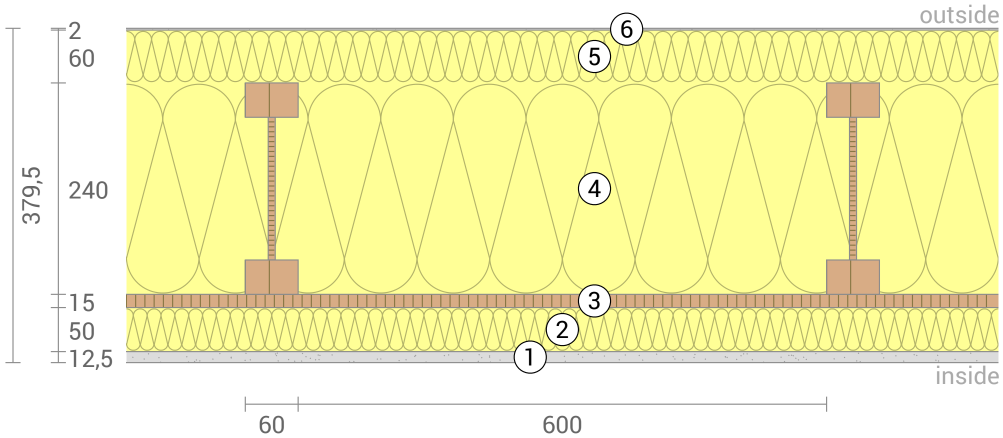
Thermal contact resistances have been taken from DIN 6946 Table 7.
Rsi: heat flow direction horizontally
Rse: heat flow direction horizontally, outside: Direct contact to outside air

Upper limit of thermal resistance $R_{tot;upper}$ = 9,136 m²K/W.
Lower limit of thermal resistance $R_{tot;lower}$ = 8,696 m²K/W.
Check applicability: $R_{tot;upper}$ / $R_{tot;lower}$ = 1,051 (maximum allowed: 1,5)

The procedure may be used.

Thermal resistance $R_{tot} = (R_{tot;upper} + R_{tot;lower})/2$ = 8,916 m²K/W
Estimated maximum relative uncertainty according to section 6.7.2.5: 2,5%

Heat transfer coefficient U = $1/R_{tot}$ = **0,11 W/(m²K)**



240 mm JOIST + 60 mm + vakolat, belül 50 mm installal, U=0,11 W/(m²K)

# LCA

## Heat loss: 10 kWh/m² per heating season

Amount of heat that escapes through one square meter of this component during the heating period. Please note: Due to internal and solar gains, the heating demand is lower than the heat loss.

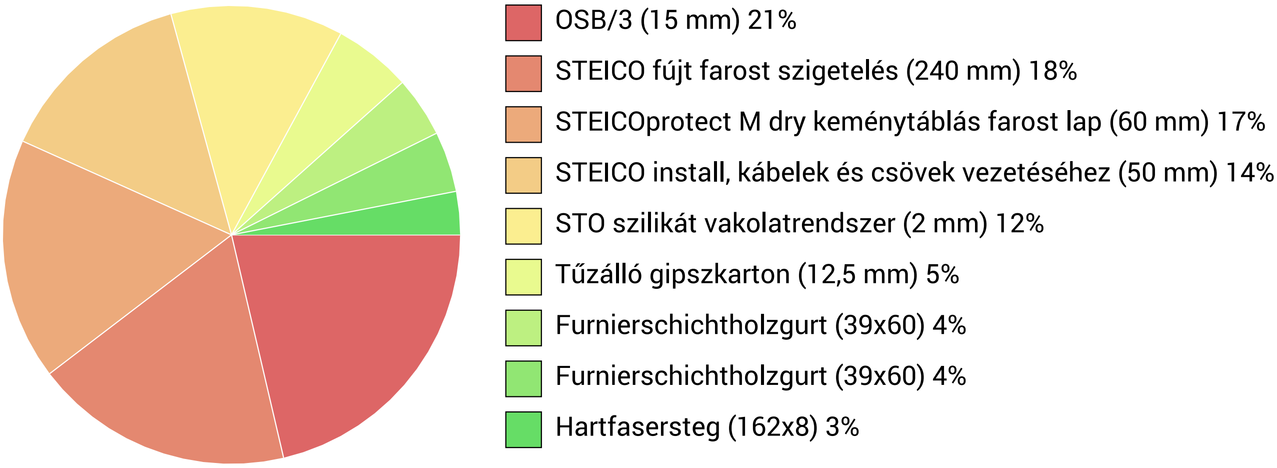
## Primary energy (non renewable): 165 kWh/m²

Non-renewable primary energy (= energy from fossil fuels and nuclear energy) that was used to produce the new building materials ("cradle to gate").

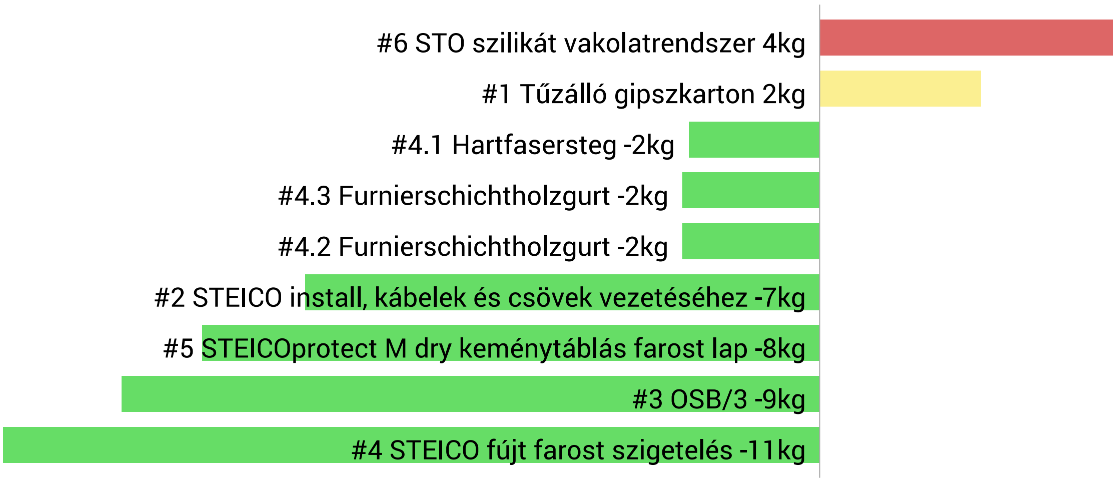
## Green house gas potential: -34 kg CO2 Äqv./m²

For the production of the building materials used, more greenhouse gases were withdrawn from the atmosphere than emitted.

## Composition of non-renewable primary energy of production:




## Composition of the greenhouse potential of production:

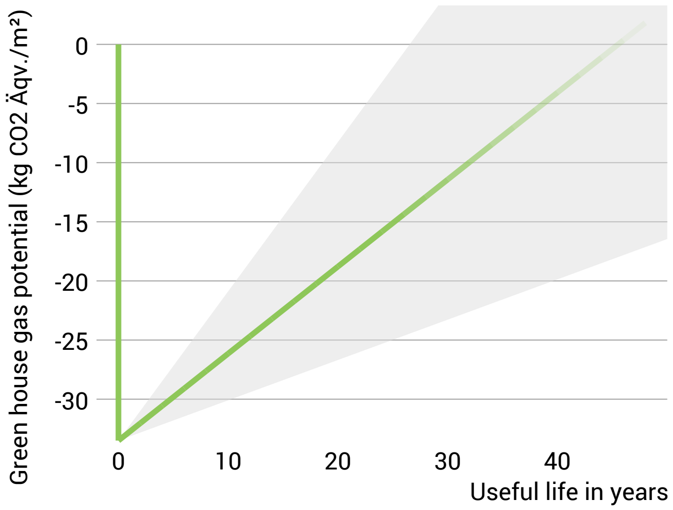


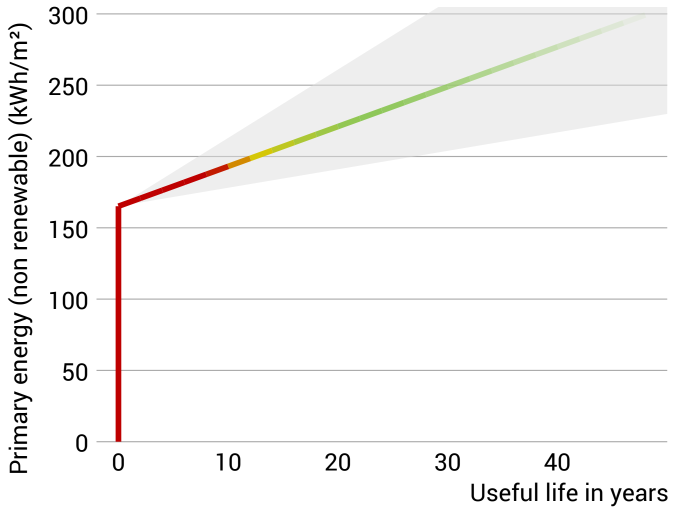



Click here to edit the construction on www.ubakus.de.

240 mm JOIST + 60 mm + vakolat, belül 50 mm installal, U=0,11 W/(m²K)

# Global warming potential and primary energy for construction and use




The **left figure** shows the global warming potential of the production of the component in the vertical part of the curve. Greenhouse gas emissions (through heating) arising during use of the building are indicated by the upward curve.

The **figure at the bottom left** shows the non-renewable primary energy expenditure for the production of the component in the vertical part of the curve. The primary energy required during use of the building (through heating) is represented by the upward curve.

The longer the component is used unchanged, the more environmentally friendly it is, because the production costs contribute less to the total emissions (indicated by the color of the curve).

Due to unknown solar and internal gains, the heating demand can only be estimated. Accordingly, primary energy consumption and global warming potential during the use phase are only vaguely known. For the estimation it was assumed that solar and internal profits contribute with 4 kWh/a/m² component area. The light gray area indicates the area in which the curve is located with great certainty. For heat generation, a primary energy input of 0,50 kWh per kWh of heat and a global warming potential of 0,13 kg CO2 eqv/m² per kWh of heat was used. Heat source: Heat pump (soil).

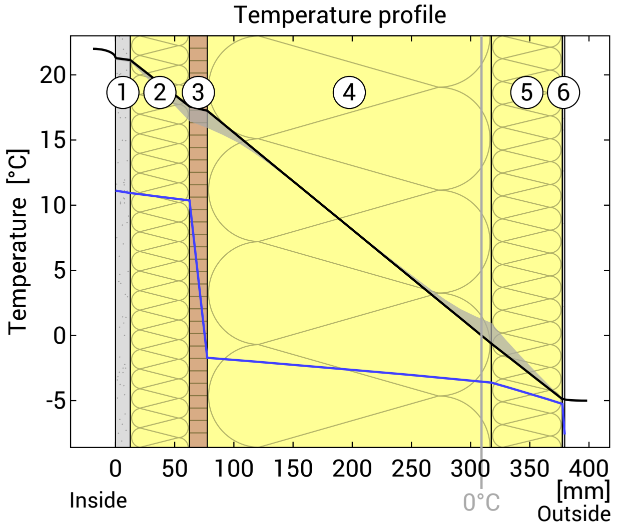
## Hints

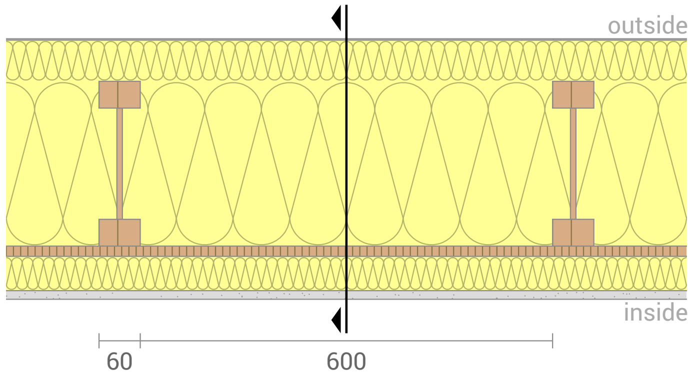
Calculated for the location Wien, heating period from Mid of October to End of April. The calculation is based on monthly average temperatures. Source: www.klimadiagramme.de

The climate and energy data on which this calculation is based can, in some cases, show considerable fluctuations and, in individual cases, deviate considerably from the actual value.

240 mm JOIST + 60 mm + vakolat, belül 50 mm installal, U=0,11 W/(m²K)

## Temperature profile




① Tűzálló gipszkarton (12,5 mm)
② STEICO install, kábelek és csövek...
③ OSB/3 (15 mm)
④ STEICO fújt farost szigetelés (240 mm
⑤ STEICOprotect M dry keménytáblá...
⑥ STO szilikát vakolatrendszer (2 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 [m²K/W] | Temperatur [°C] min | max | Weight [kg/m²] |
|---|---|---|---|---|---|---|---|
| | | Thermal contact resistance* | | 0,250 | 21,2 | 22,0 | |
| 1 | 1,25 cm | Tűzálló gipszkarton | 0,250 | 0,050 | 21,0 | 21,3 | 8,5 |
| 2 | 5 cm | STEICO install, kábelek és csövek vezetéséhez | 0,040 | 1,250 | 16,4 | 21,1 | 7,0 |
| 3 | 1,5 cm | OSB/3 | 0,130 | 0,115 | 15,9 | 17,6 | 9,3 |
| 4 | 24 cm | STEICO fújt farost szigetelés | 0,038 | 6,316 | -0,6 | 17,3 | 9,2 |
| | 16,2 cm | Hartfasersteg (Width: 0,8 cm) | 0,308 | 0,526 | 2,8 | 14,1 | 1,8 |
| | 3,9 cm | Furnierschichtholzgurt (Width: 6 cm) | 0,130 | 0,300 | 14,0 | 16,2 | 1,8 |
| | 3,9 cm | Furnierschichtholzgurt (Width: 6 cm) | 0,130 | 0,300 | 0,8 | 2,8 | 1,8 |
| 5 | 6 cm | STEICOprotect M dry keménytáblás farost lap | 0,040 | 1,500 | -4,9 | 1,0 | 8,4 |
| 6 | 0,2 cm | STO szilikát vakolatrendszer | 0,700 | 0,003 | -4,9 | -4,8 | 4,0 |
| | | Thermal contact resistance* | | 0,040 | -5,0 | -4,9 | |
| | 37,95 cm | Whole component | | 8,841 | | | 51,8 |

*Thermal contact resistances according to DIN 4108-3 for moisture protection and temperature profile. The values for the U-value calculation can be found on the page 'U-value calculation'.

| | | | |
|---|---|---|---|
| Surface temperature inside (min / average / max): | 21,2°C | 21,2°C | 21,3°C |
| Surface temperature outside (min / average / max): | -4,9°C | -4,9°C | -4,9°C |

240 mm JOIST + 60 mm + vakolat, belül 50 mm installal, U=0,11 W/(m²K)

## 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: -5°C und 80% Humidity (Climate according to user input).

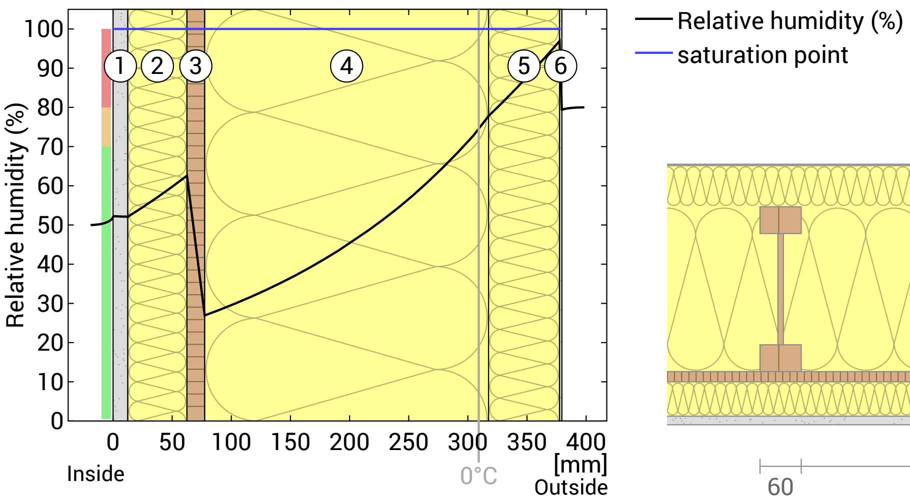
This component is free of condensate under the given climate conditions.

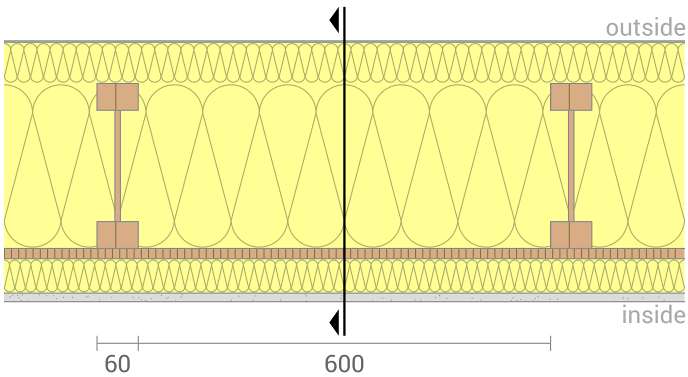
Drying reserve according to DIN 4108-3:2001: 2899 g/(m²a)
At least required by DIN 68800-2: 100 g/(m²a)

| # | | Material | sd-value [m] | Condensate [kg/m²] | [Gew.-%] | Weight [kg/m²] |
|---|---|---|---|---|---|---|
| 1 | 1,25 cm | Tűzálló gipszkarton | 0,05 | - | | 8,5 |
| 2 | 5 cm | STEICO install, kábelek és csövek vezetéséhez | 0,15 | - | | 7,0 |
| 3 | 1,5 cm | OSB/3 | 2,25 | - | - | 9,3 |
| 4 | 24 cm | STEICO fújt farost szigetelés | 0,24 | - | | 9,2 |
| | 16,2 cm | Hartfasersteg (Width: 0,8 cm) | 1,62 | - | - | 1,8 |
| | 3,9 cm | Furnierschichtholzgurt (Width: 6 cm) | 0,78 | - | - | 1,8 |
| | 3,9 cm | Furnierschichtholzgurt (Width: 6 cm) | 1,95 | - | - | 1,8 |
| 5 | 6 cm | STEICOprotect M dry keménytáblás farost lap | 0,18 | - | | 8,4 |
| 6 | 0,2 cm | STO szilikát vakolatrendszer | 0,22 | - | | 4,0 |
| | 37,95 cm | Whole component | 3,21 | 0 | | 51,8 |

### Humidity

The temperature of the inside surface is 21,2 °C leading to a relative humidity on the surface of 52%.Mould formation is not expected under these conditions.
The following figure shows the relative humidity inside the component.




① Tűzálló gipszkarton (12,5 mm) ② STEICO install, kábelek és csövek... ③ OSB/3 (15 mm) ④ STEICO fújt farost szigetelés (240 mm) ⑤ STEICOprotect M dry keménytáblá... ⑥ STO szilikát vakolatrendszer (2 mm)

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.

240 mm JOIST + 60 mm + vakolat, belül 50 mm installal, U=0,11 W/(m²K)

# Moisture protection in accordance with DIN 4108-3:2001 Appendix A

The temperatures and / or humidities you specified are not in accordance with DIN 4108-3. This analysis was carried out with the values specified by DIN 4108-3: 20°C / 50% humidity inside and -10°C / 80% humidity outside.

This moisture proofing is only valid for **non-air-conditioned** residential buildings.

Please note the hints at the end of these moisture proofing calculations.

| # | | Material | λ [W/mK] | R [m²K/W] | sd [m] | ρ [kg/m³] | T [°C] | ps [Pa] | ∑sd [m] |
|---|---|---|---|---|---|---|---|---|---|
| | | Thermal contact resistance | | 0,130 | | | | | |
| | | | | | | | 19,59 | 2279 | 0 |
| 1 | 1,25 cm | Tűzálló gipszkarton | 0,250 | 0,050 | 0,05 | 680 | | | |
| | | | | | | | 19,43 | 2256 | 0,05 |
| 2 | 5 cm | STEICO install, kábelek és csövek vezetéséhez | 0,040 | 1,250 | 0,15 | 140 | | | |
| | | | | | | | 15,44 | 1754 | 0,2 |
| 3 | 1,5 cm | OSB/3 | 0,130 | 0,115 | 2,25 | 620 | | | |
| | | | | | | | 15,07 | 1712 | 2,45 |
| 4 | 24 cm | STEICO fújt farost szigetelés | 0,038 | 6,316 | 0,24 | 40 | | | |
| | | | | | | | -5,08 | 398 | 2,69 |
| 5 | 6 cm | STEICOprotect M dry keménytáblás farost lap | 0,040 | 1,500 | 0,18 | 140 | | | |
| | | | | | | | -9,86 | 262 | 2,87 |
| 6 | 0,2 cm | STO szilikát vakolatrendszer | 0,700 | 0,003 | 0,22 | 2000 | | | |
| | | | | | | | -9,87 | 262 | 3,09 |
| | | Thermal contact resistance | | 0,040 | | | | | |

Temperature (T), vapor saturation pressure (ps), and the sum of the sd-values (Σsd) apply to the layer boundary.

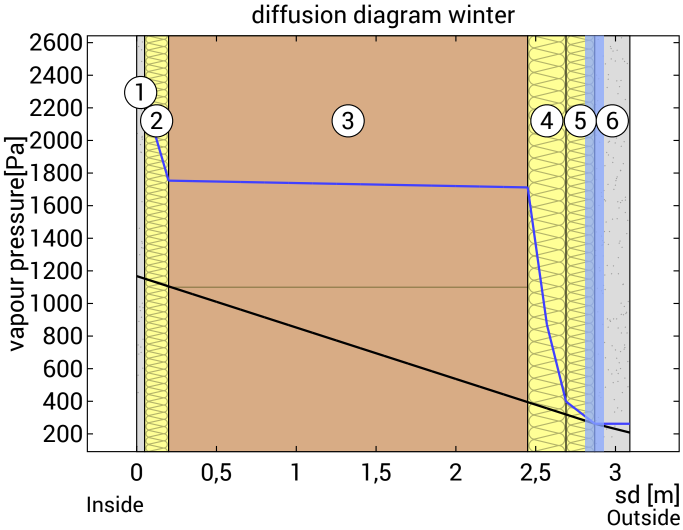
## Relative air humidity on the surface

The relative humidity on the interior surface is 51%. Requirements for the prevention of building material corrosion depend on material and coating and have not been investigated.

✓

## Dew period (winter)

| Boundary conditions | |
|---|---|
| Vapor pressure inside at 20°C and 50% humidity | pi = 1168 Pa |
| Vapor pressure outside at -10°C and 80% humidity | pe = 208 Pa |
| Duration of condensation period (60 days) | tc = 5184000 s |
| Water vapor diffusion coefficient in static air | δ0 = 1.852E-10 kg/(m*s*Pa) |
| sd-value (Whole component.) | sde = 3,09 m |




① Tűzálló gipszkarton (12,5 mm), sd=0,05 m
② STEICO install, kábelek és csövek vezetéséhez (50 mm), sd=0,15 m
③ OSB/3 (15 mm), sd=2,25 m
④ STEICO fújt farost szigetelés (240 mm), sd=0,24 m
⑤ STEICOprotect M dry keménytáblás farost lap (60 mm), sd=0,18 m
⑥ STO szilikát vakolatrendszer (2 mm), sd=0,22 m

**Condensation area $c_1$:** Layer boundary between STEICOprotect M dry keménytáblás farost lap and STO szilikát vakolatrendszer
at $sd_{c1}$=2,87 m; $p_{c1}$=262 Pa; x1=37,75 cm

Condensate amount: $Mc = tc * \delta 0 * ((p_i - p_{c1})/sd_{c1} - (p_{c1} - p_e)/(sd_e - sd_{c1}))$ = **0,067 kg/m²**

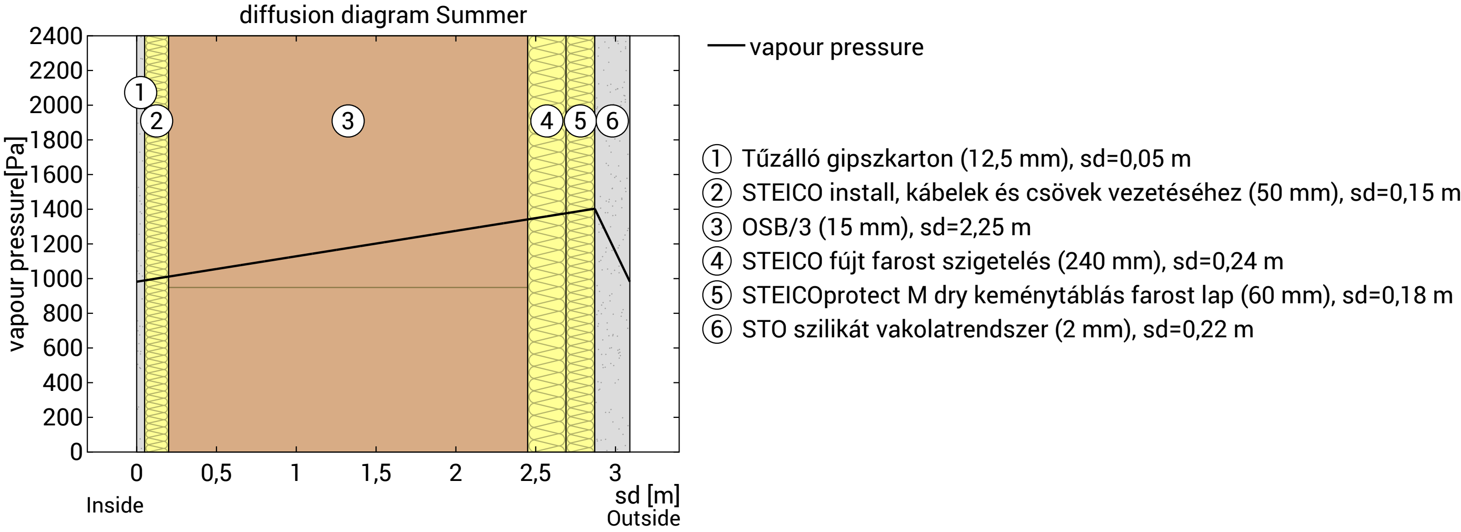
STEICOprotect M dry keménytáblás farost lap wird als wasseraufnahmefähig eingestuft weil Aw ≥ 0.5 ist.
Für Schicht STO szilikát vakolatrendszer wurde noch kein Wasseraufnahmekoeffizient hinterlegt. Es wird deshalb angenommen, dass mindestens eine Schicht nicht kapillar wasseraufnahmefähig ist.

The maximum allowed amount of condensation water is at least 0,5 kg/m².

Total amount of condensate: Mc = **0,067 kg/m²** ✓

## Evaporation period (summer)

| Boundary conditions | |
|---|---|
| Interior vapor pressure | pi = 982 Pa |
| Exterior vapor pressure | pe = 982 Pa |
| Saturation vapour pressure in the condensation area | ps = 1403 Pa |
| Length of drying season (90 days) | tev = 7776000 s |
| sd-values remain unchanged. | |




Maximum possible evaporation mass
Mev = tc * δ0 * ((ps-pi)/$sd_{c1}$ + (ps-pe)/($sd_e$-$sd_{c1}$)) = **2,966 kg/m²**
The condensation amount of 0,067 kg/m² can dry completely. ✓

## Evaluation according to DIN 4108-3

The component is permissible regarding the moisture protection.

## Drying reserve (DIN 68800-2)

Drying reserve: Mr = (Mev - Mc) * 1000 = **2899 g/m²/a**
Minimum requested for walls and ceilings: 100 g/m²/a ✓

## Hints

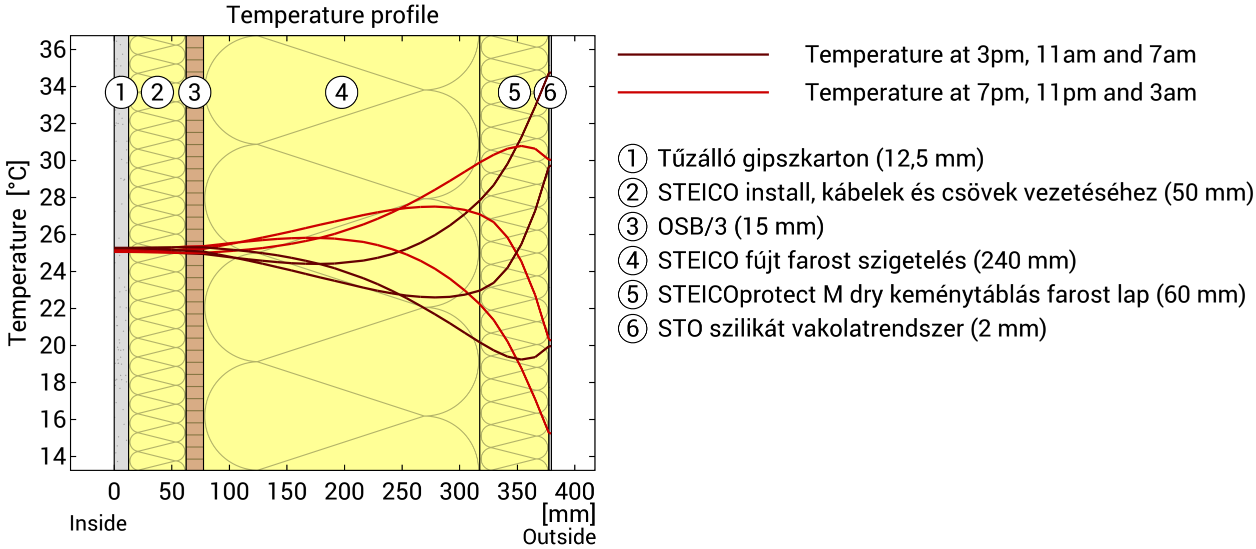
In the case of inhomogeneous constructions, such as skeleton-, stand- or frame constructions, as well as in wooden beam, rafter or half-timbered constructions or the like, the one-dimensional diffusion calculations are only to be demonstrated for the compartment area. Exceptional cases are special constructions in which, for example, The diffusion-inhibiting layer is also laid section-wise over the outer area. In these exceptional cases, the calculation performed here is invalid.

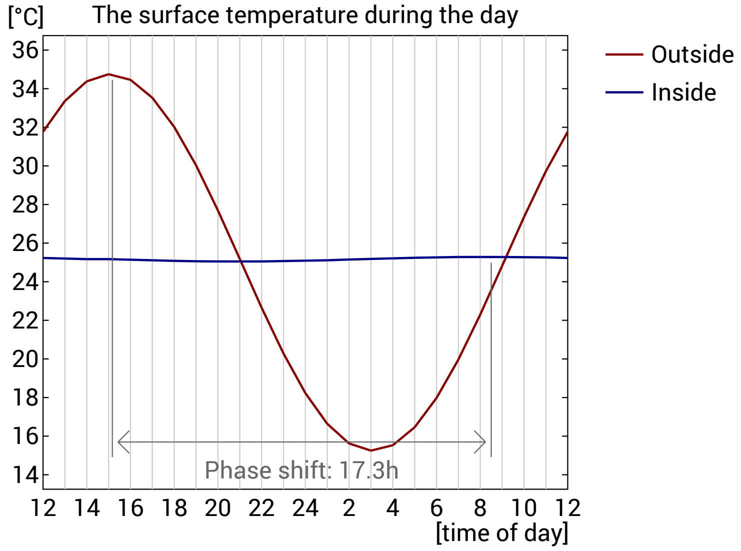
DIN 4108-3 describes in Section 5.3 components for which no moisture proofing is required as there is no risk of condensation water or the method is not suitable for the assessment. It is not possible to assess whether the component under test is underneath.

240 mm JOIST + 60 mm + vakolat, belül 50 mm installal, U=0,11 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* | 17,3 h | Heat storage capacity (whole component): | 88 kJ/m²K |
| Amplitude attenuation ** | 81,3 | Thermal capacity of inner layers: | 51 kJ/m²K |
| TAV *** | 0,012 | | |

* 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.