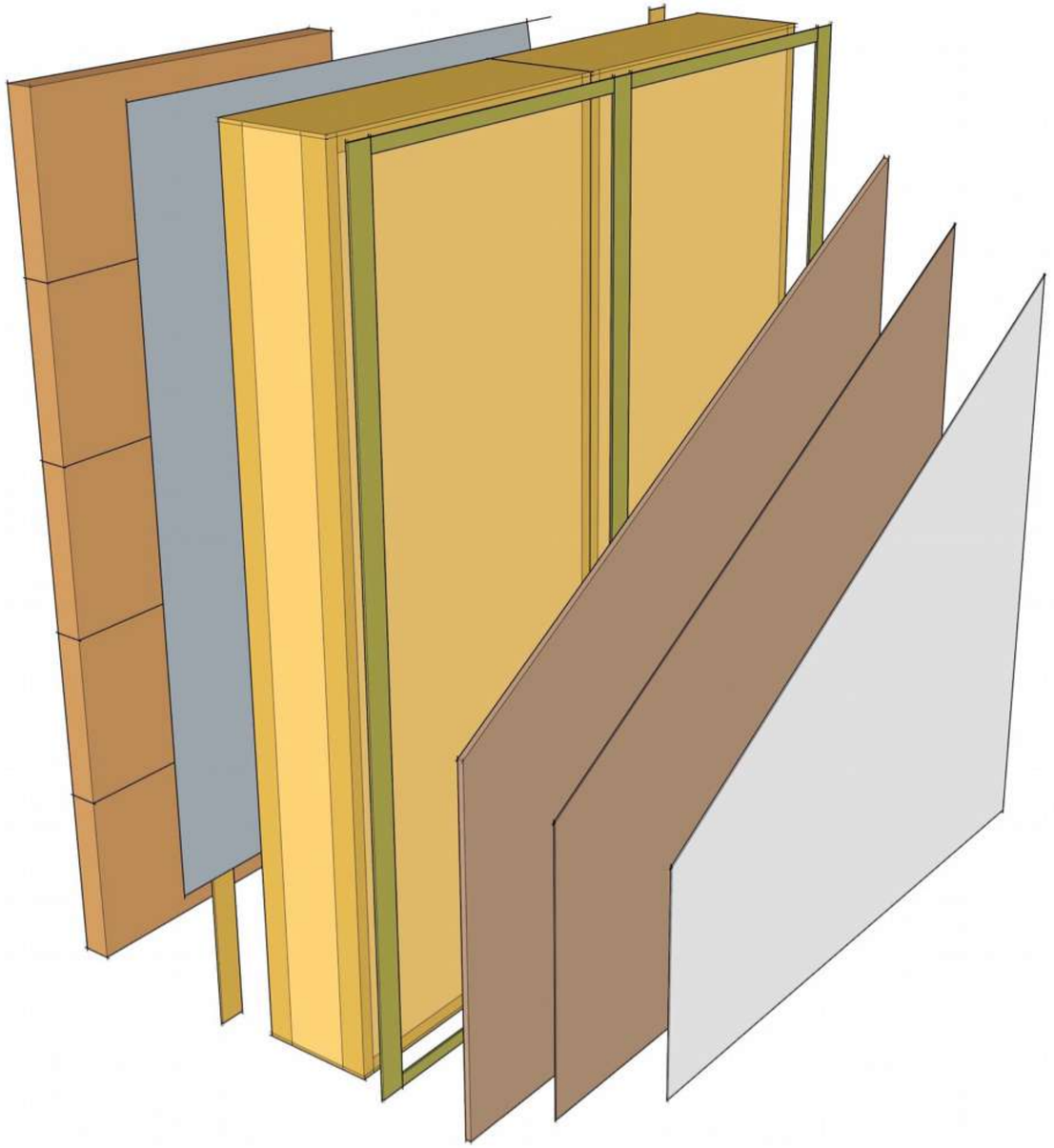
C3a

Building Physics Guide

01 Panel Layers

Panel buildup from inside



Steps

» Thin 5 mm wood fibre boards applied after roof is finished
» 2 layers of clay base coat
» Final clay plaster

Note

» Clay can be applied directly on the straw
» A mesh should be used in the base coat
» The first base coat will crack due to natural contraction during drying

Alternatives

» Any boards (plywood, gypsum boards etc.) that have a higher sd value than clay can be used inside.
» In this case use strips of wood instead of thin wood fibre boards

Panel buildup from outside

Steps

» Panels are covered immediately with an airtight but diffusion open membrane

» All connections need to be taped (60 mm wide tape)

» Plywood strips secure the membrane in place

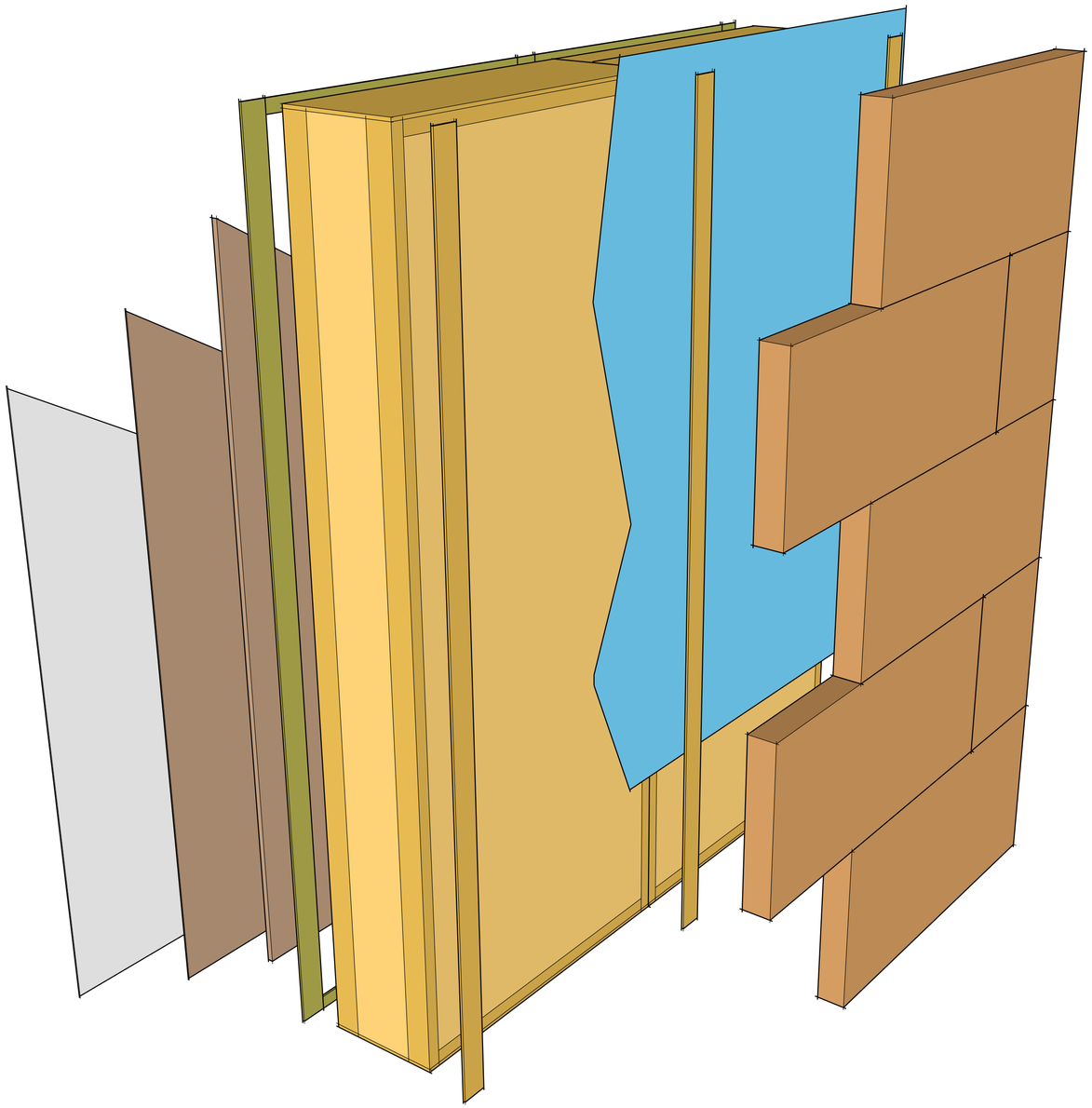
Note

» Always ensure there is overlap

» Be careful to leave enough membrane to connect to the inside membrane

Careful:

» Never use an inside membrane on the outside! Any membrane used inside has a higher sd-value and is not suitable.



02

U-Values

U-values calculation: Based on Technical Certificate

- In the Technical Certificate, the thermal resistance for straw is defined at 0.056 W/mK. For wood 0.13 W/mK is used.
- In a U-value calculation where there is 10% wood and 90% straw (average for a complete wall), the resulting U-value is: U = 0.145 W/m2K or R= 6.9 m2/WK
- This value is for straw panels without clay plaster or wood fibre board.

Note

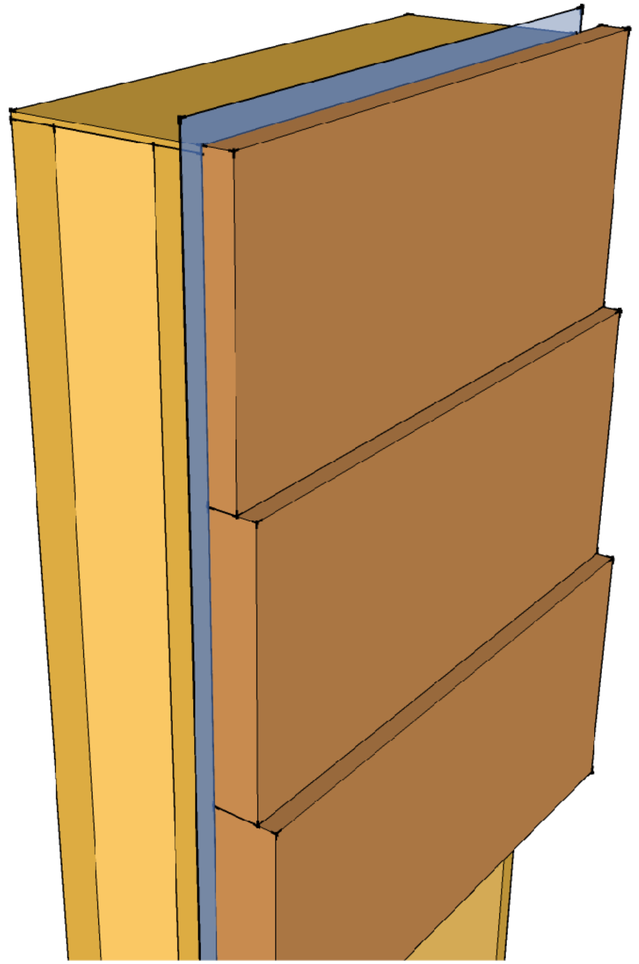
- In Austria, straw insulation is officially used with a better value of 0.05 W/mK.

Characteristics

- Final U-value depends on thickness of wood fibre board

Available upon request

- Excel calculation temlpate for U-value calculation



U-values with wood fibre board:

60 mm - U=0.121 W/m²K

100 mm - U=0.110 W/m²K

140 mm - U=0.100 W/m²K

Calculated layer values:

0.700 W/mK for clay (30 mm)
0.056 W/mK for Straw (400 mm, 90%)
0.130 W/mK for Wood (400 mm, 10%)
0.046 W/mK for wood fibre board
1.400 W/mK for plaster (7 mm)

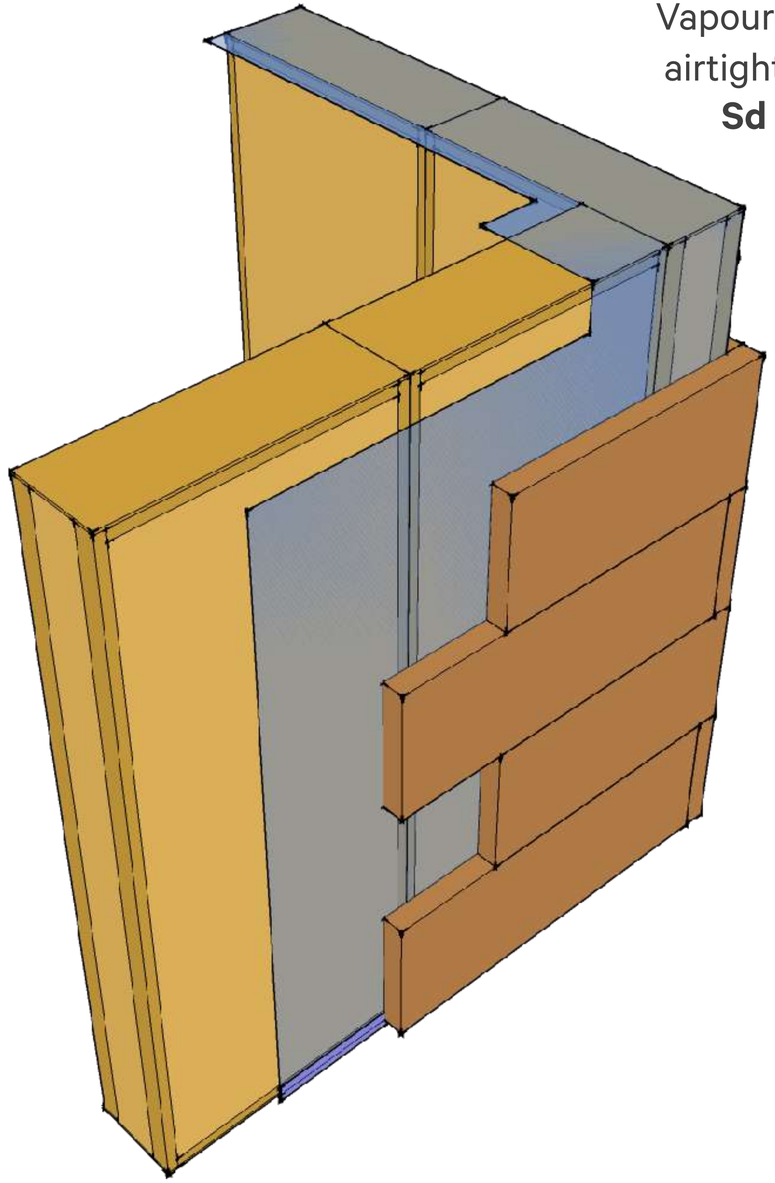
03 Airtightness

Airtight, but open to vapour

- The airtight layer is on the outside of the straw. We use an airtight layer that is completely permeable for humidity.
- The membrane is mounted immediately during construction, and protects the straw against rain.
- The fibres in the wood fibre board help to move humidity from the airtight layer to the outside surface where it can evaporate.
- The wood fibre board further protects the straw from moisture damage from the exterior.

Note

- Always use airtight membrane open for vapour - Sd < 0.2 m (equivalent of 20 cm air gap)
- No leakage of moist air means no damages from condensation
- Verify airtightness with a Blower Door Test



Vapour-permeable airtight layer with **Sd < 0.2 m**

Airtight & rain protection during construction

Note

» Membrane can protect walls against rain until you mount the wood fibre boards

» Saves time otherwise used for covering the building

» Airtight membrane should be applied the same day the EcoCocon panels are assembled

» Attach membrane with plywood strips to fix well against wind

Tip

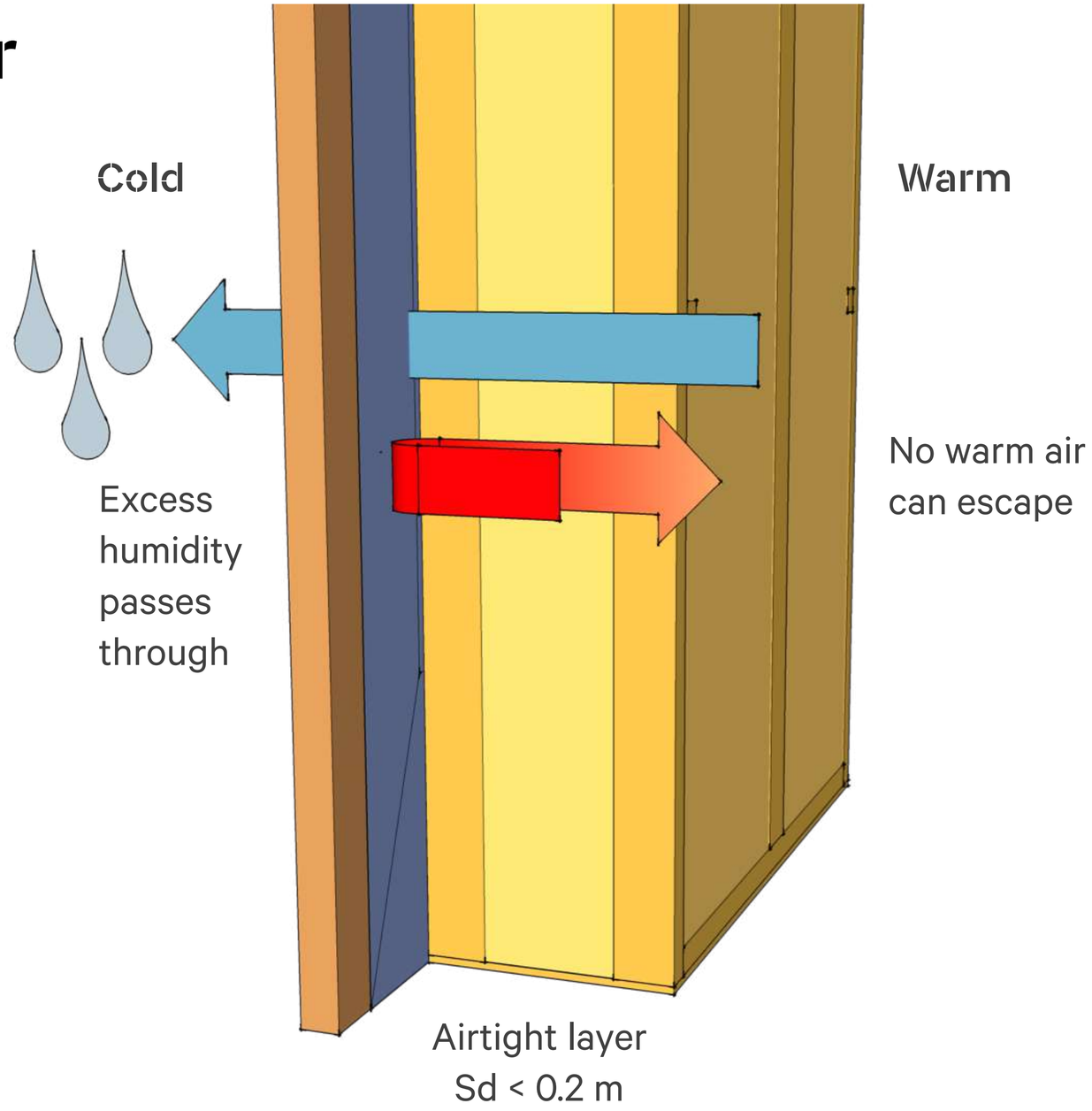
» Cover also the window openings - you can cut them open later

Airtight, but open to vapour

- Humidity passes through construction by difference of temperature and always from warm to cold side
- This transport is very slow compared to transport by Airflow
- Airflow is the main reason why condensation might occur and can be very damaging to the structure
- The materials on the outside have to be completely diffusion open
- Natural materials (wood fibre, cellulose, straw) are good at transporting moisture due to fibre content

Note

- View WUFI calculation reports for detailed information

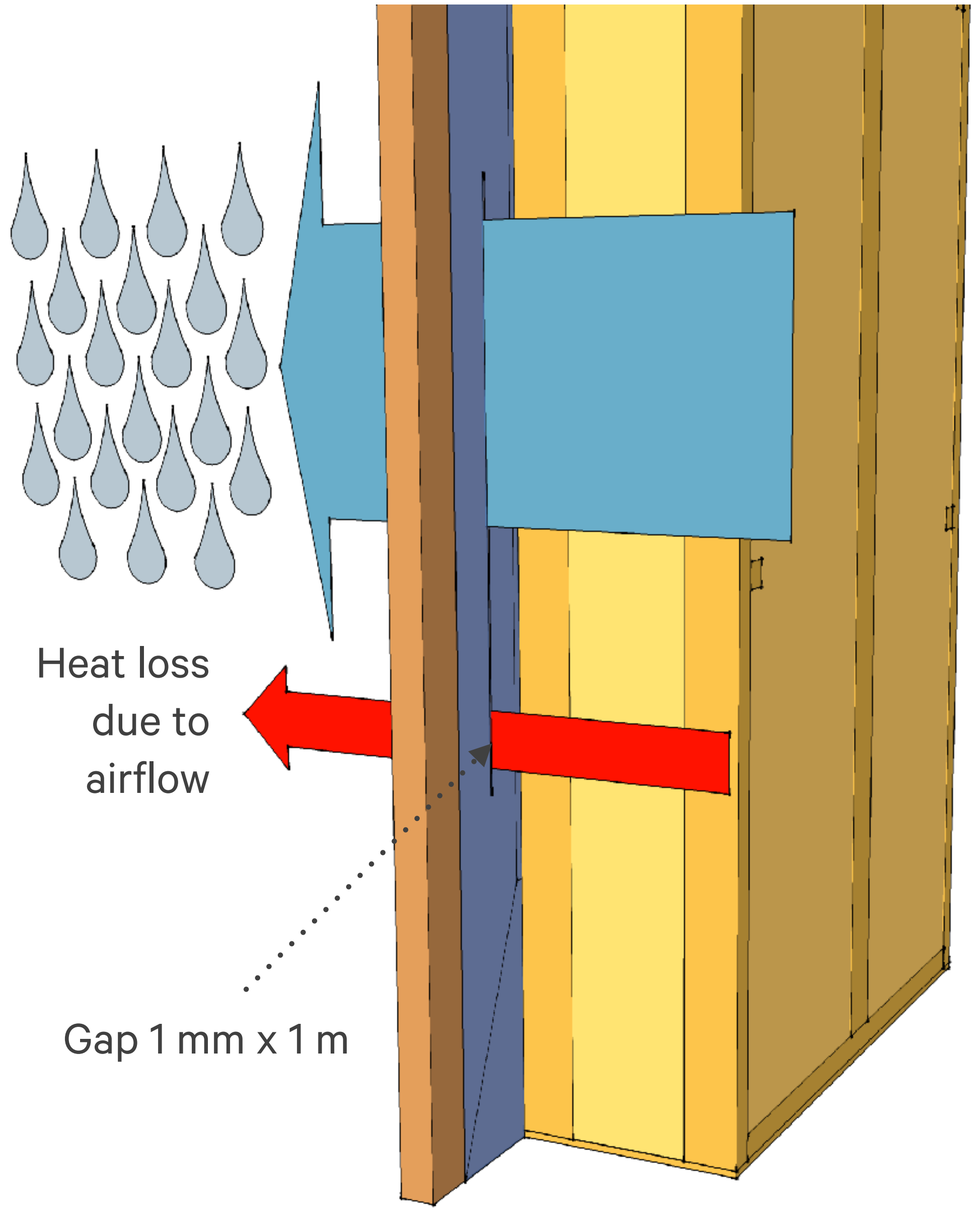


Danger of damages by leaking humid air flow

In a cold climate, warm and humid interior air can condense in the construction, if there is an air leak in the envelope.

A properly installed airtight membrane and a Blower Door Test helps to ensure there are no such leaks.

Even a small leak can produce a lot of humidity, up to 360 g per day for a gap 1 mm wide and 1 m long.



Note

- Careful detailing of all connections
- Identify leaks with a BDT during construction
- Use special elements to ensure airtight connection for cables

04

WUFI Calculation

Airtight layer: WUFI Calculation

The airtight layer has been verified by German Building Physicist Brandhorst using WUFI.

For the cold climate in Vienna a dynamic calculation over several years has been made.

Note

» The system should work for all climates except areas with very long extended winters and permafrost - above polar circle.

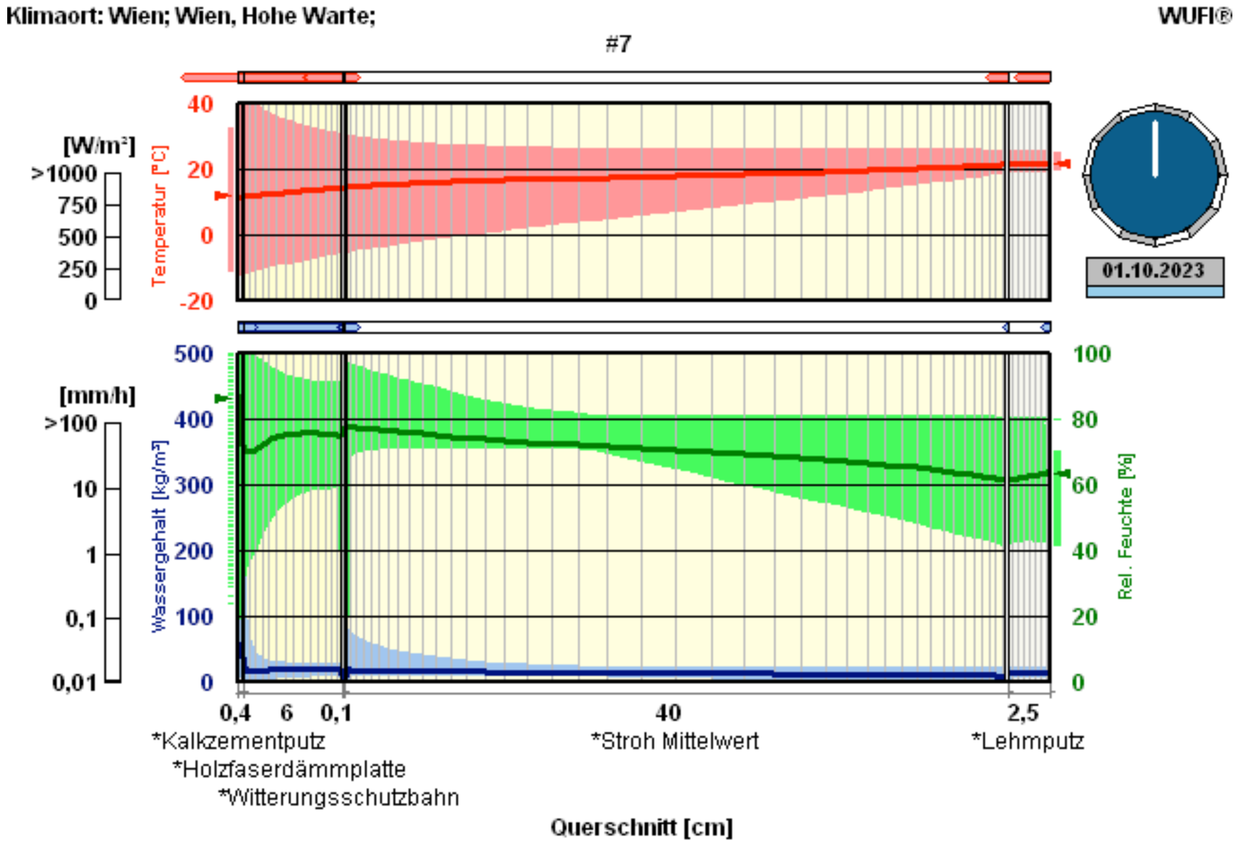
» The system works also for hot and humid climates. Miami was calculated as an example.

» Airtight construction and verification by Blower Door Test is absolutely necessary!

Documents for download

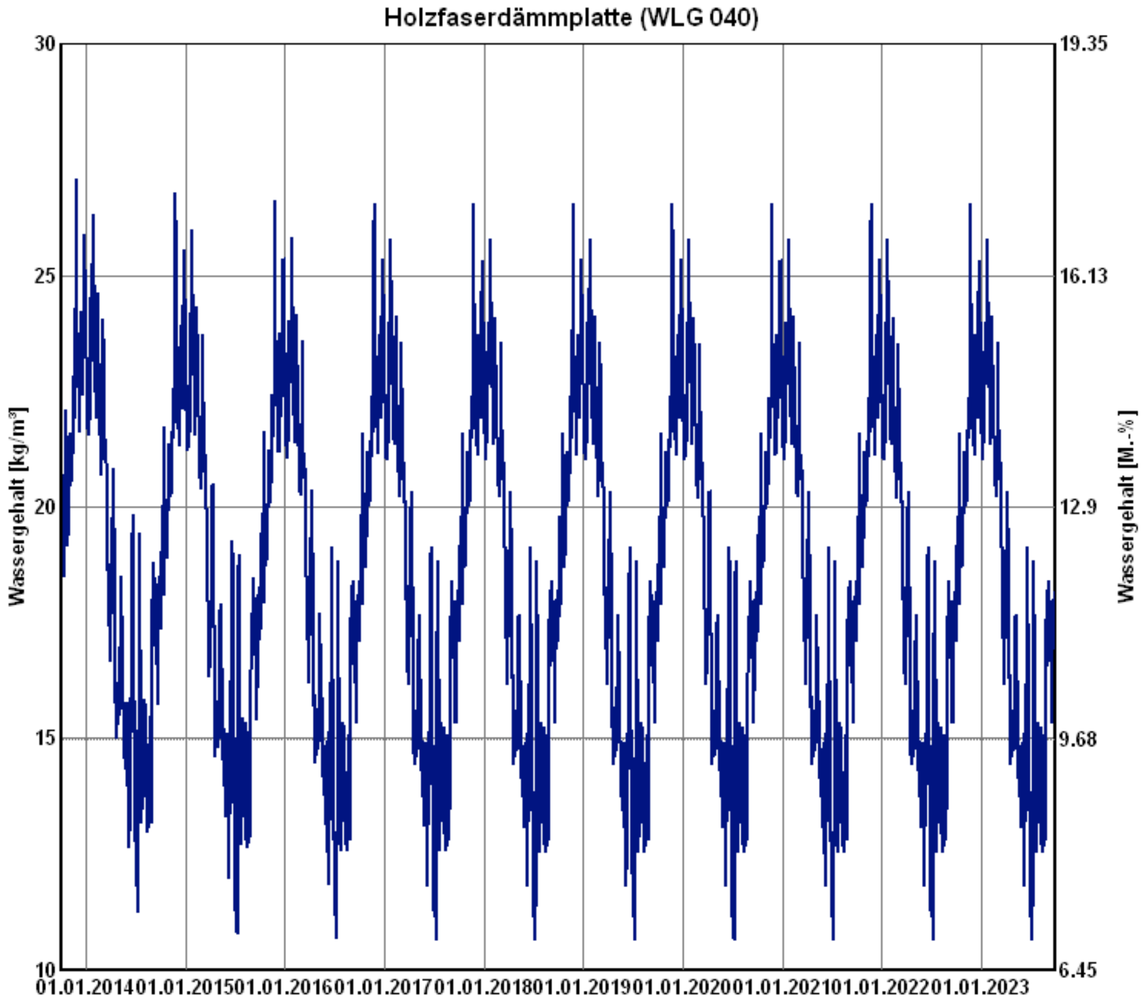
» Wufi documents and videos

Whole construction:



Airtight layer: WUFI Calculation

Wood fibre insulation board:



Wood fibre boards move the excess humidity away from the membrane very efficiently

Characteristics

- Although there is an increase in humidity in cold months, this is inside the limit of 25% water content in the wood fibre board
- Wood fibre boards dry out very quickly during summer