



Ansitz Kofler

Author: Eleonora Leonardi (EURAC)

Mineral wool with vapour barrier- Solution 1

Walls

What is the solution?

In this example all walls except the western facade were internally insulated. XPS was used in the lower part and placed all around the perimeter in direct contact with the floor insulation. From about half a meter upwards 14 cm thick mineral wool panels (FLUMROC Compact) form the main insulation layer. The following OSB panel serves as support for the vapour barrier ($sd > 100$ m), special attention was paid to seal all joints with tape. At the junction with the ceiling, the vapour barrier of the wall and the vapour retarder ($sd = 2.0$) of the ceiling were overlapped and taped. All wet piping, electrical wiring and ductwork is placed in the 4 cm thick installation layer - resulting in a total of $14 + 4 = 18$ cm of insulation and no installation breaking through the vapour barrier. The internal surface was finished with 2.5 cm plasterboard. In the bedroom (west façade), instead of mineral wool insulation, wood fibre boards were used.

Cross section of the wall build-up, available pictures of the solution:



Plaster Boards, ©Eurac



Internal insulation in the sleeping room:
wood fiber, ©Eurac



Internal vapour barrier, ©Eurac



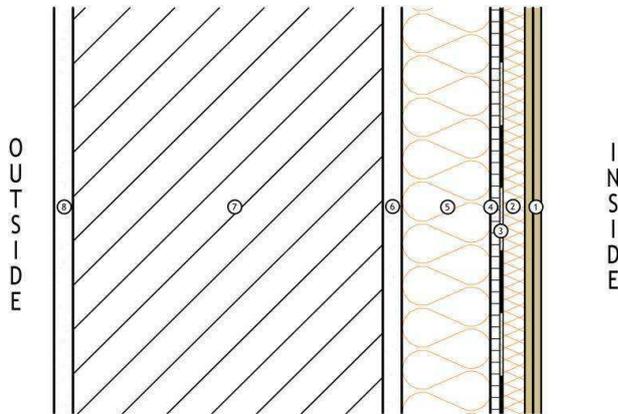
Internal insulation (mineral wool) and OSB,
©Eurac



Vapour Barrier and ceiling, ©Eurac

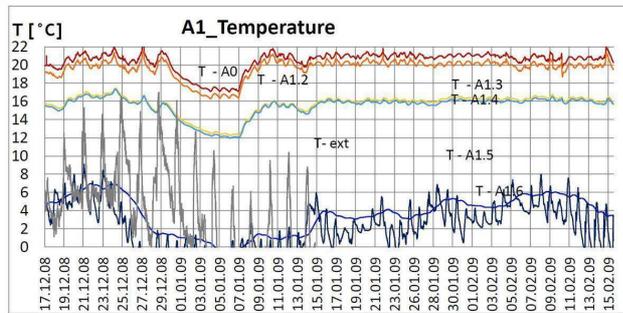


Installation layer, ©Eurac

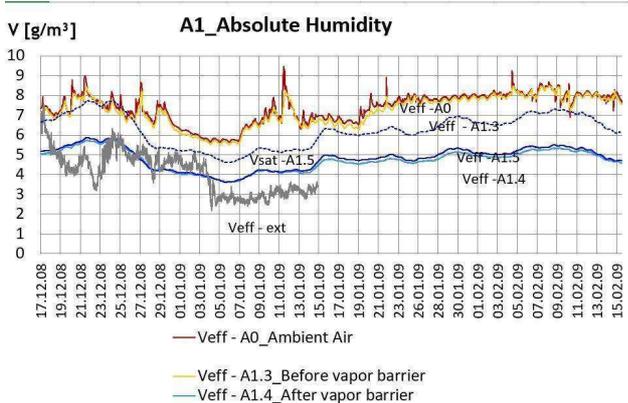
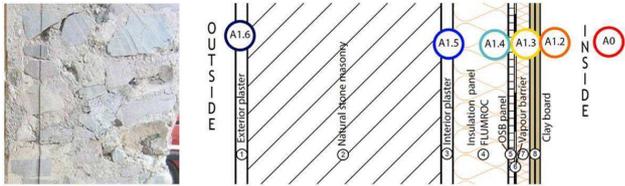


Cross section, ©Eurac

- ① Clay board, 25mm
- ② Insulation panel FLUMROC, installation layer, 40mm
- ③ Vapour barrier
- ④ OSB-panel
- ⑤ Insulation panel FLUMROC, glued holoedral, 140mm
- ⑥ Interior plaster (leveling layer), 30mm
- ⑦ Natural stone masonry
- ⑧ Exterior plaster ca. 20mm



Monitoring system: construction's temperatures, ©Eurac



Monitoring system: construction's absolute humidity, ©Eurac

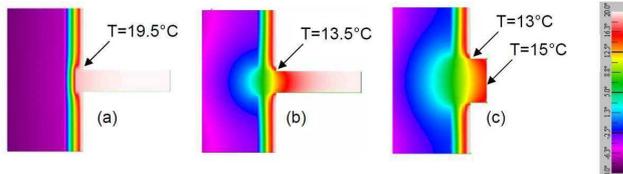


Figure 5. 2-dimensional simulation of partition wall abutting outside wall with Therm 5.2 for (a) thermal division (b) no thermal division and (c) special situation at the arch.

Thermal Bridges, ©Eurac



Building after renovation, ©Eurac

Why does the solution work in terms of compatibility with conservation, moisture safety and energy improvement?

The external proportions of the building had to be kept the same, thus the choice of internal insulation. The thick internal insulation layer brings to consistent energy savings. The system uses mineral wool with a vapour barrier.

The vapour barrier reduces the vapour diffusion and the airtight layer make sure that no convective moisture transport can happen. Special attention has been given to preventing thermal bridges. Where partition walls abut outside walls, wherever possible, the internal wall was cut and insulation placed vertically against the wall. Where new partition walls were built up, interspaces to the external wall were left in order to place insulation, OSB-boarding and vapour barrier behind. However, in some situations the wall was a bearing one and thus could not be cut. Therefore, insulation on the border had to be applied. In one corner an old chimney was found – and by insulating that internally the supplementary insulation along the partition wall could be avoided. The elimination of thermal bridges was not always possible: in the bedroom an arch as separating and supporting element could neither be cut nor insulated alongside. Internal insulation and vapour barrier were brought there until the borders of the arch and finished with plaster. A sensor for temperature and humidity is monitoring this potentially critical point.

Description of the context:

The main building of "Ansitz Kofler" was built in 1749. The Orangerie was added a bit later: a 30 m long and 5 m wide structure with spacious and bright rooms, used for breeding tropical fruits - for which the climate in Bozen, even if south of the Alps, would otherwise have been too harsh. In 1925 the Orangerie was converted to a dwelling: the windows were scaled down, and internal partition walls were added, forming a suite of rooms aligned with each other (so called enfilade). As typical for buildings of this age in Bozen, the loadbearing structure is stone masonry, with stones of different size, taken from the rivers in the area.

Pros and cons of the solution:

The main advantages of this solution are: use of materials that are well established in the market; the design foresees a service layer that prevents accidental damages and punctures of the vapour control layer. The main disadvantages, as the most internal insulation with vapour control system, is the need of reliability on execution of the vapour control layer; the thermal bridges are difficult to prevent and require a special attention in the design. Another disadvantage of this solution is the use of non-natural/original materials.

Type of data available (level of information, simulation):

The building is very well documented, plans and pictures are available. The building is monitored within a research project, a vast amount of monitoring

data are available, including hygrothermal performance of the construction. The building was monitored for one year.

Additional Information:

Monitoring results: a solution with vapour barrier ($s_d > 100$ m) was opted for the owner and architect at Anstz Kofler aimed at an insulation thickness that was considerably higher than the ~8 cm capillary active insulation – usually assumed safe at that time in practice. Accordingly, high effort was put in avoiding any potential failure: any penetration of the vapour barrier was avoided (4 cm installation layer), sealing tapes were applied with care, a blower door test was done after preliminary installation to attest airtightness in a phase where they could still intervene etc. The monitored data indicate safe conditions. The first image on the T profile shows that indoor surface is slightly colder than indoor air, temperatures before and after the vapour barrier are practically identical, the major temperature difference was observed along the main insulation (Δ A1.4-A1.5), and nearly no temperature difference was observed along the ancient stone wall (Δ A1.5-A1.6) – interesting to see that main effect of the stone wall is to level out daily variations. A look at the absolute humidity (g/m^3) demonstrates the effective operation of the vapour barrier: while indoors it varies between 7-8 g/m^3 – measured values of the air and inside the construction before the barrier being very similar – outdoors it is generally about 2 g/m^3 lower.