ASBP The Alliance for Sustainable Building Products

Impact of insulation type and depth on condensation risk

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Rethinking IWI with Natural Fibre Insulation

NATURAL FIBRE INSULATION GROUP

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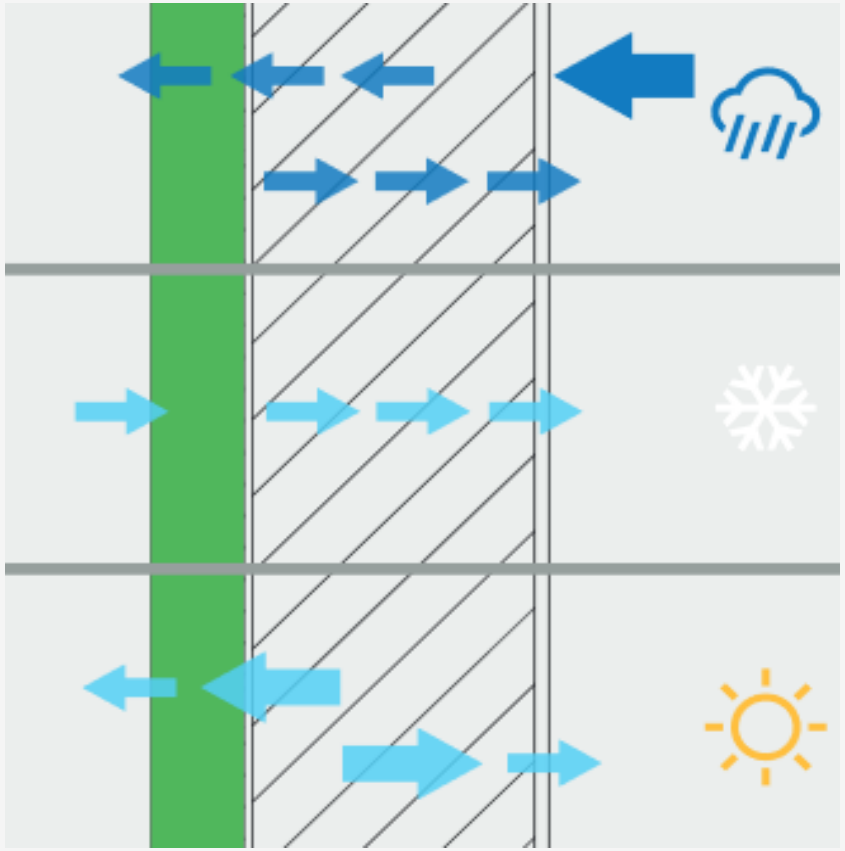
Context – What’s the right insulation type?

Key points to consider:

- There are a multitude of systems available and all of them claim to do the job.
- These range from vapour closed petro chemicals to vapour open naturals. The water vapour resistance factor of materials is a key indicator of how each material deals with moisture and hence condensation risk.
- A high water vapour resistance (mu value) means that water vapour is blocked, a low water vapour resistance means that moisture is allowed to pass through. But which is better?

- To understand this we need to know how moisture moves through the building fabric -

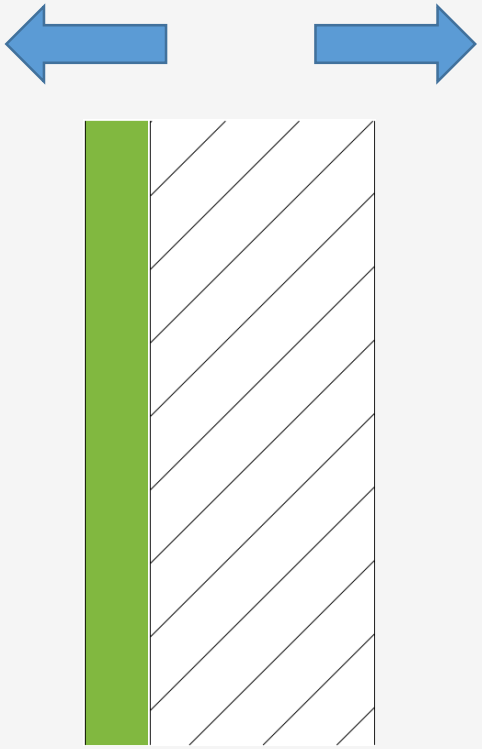
The building fabric and moisture movement



- External rain – Process – moisture transport through sorption and capillary action - influenced by the water absorption co-efficient of the external face
- Internal moisture – process - moisture transfer through diffusion from the inside to the outside – influenced by the internal and external water vapour resistance values
- Sunshine – Process - moisture transfer through diffusion from the inside and the outside – influenced by the internal and external water vapour resistance values

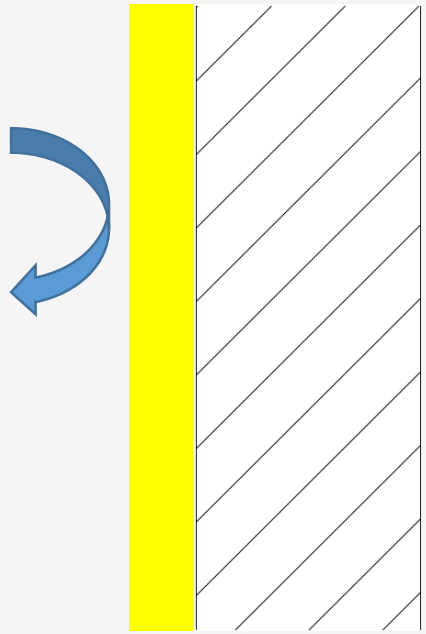
And all of these processes need to be considered simultaneously in order to provide a robust, long term solution which ensures a comfortable internal climate.

The building fabric and moisture movement



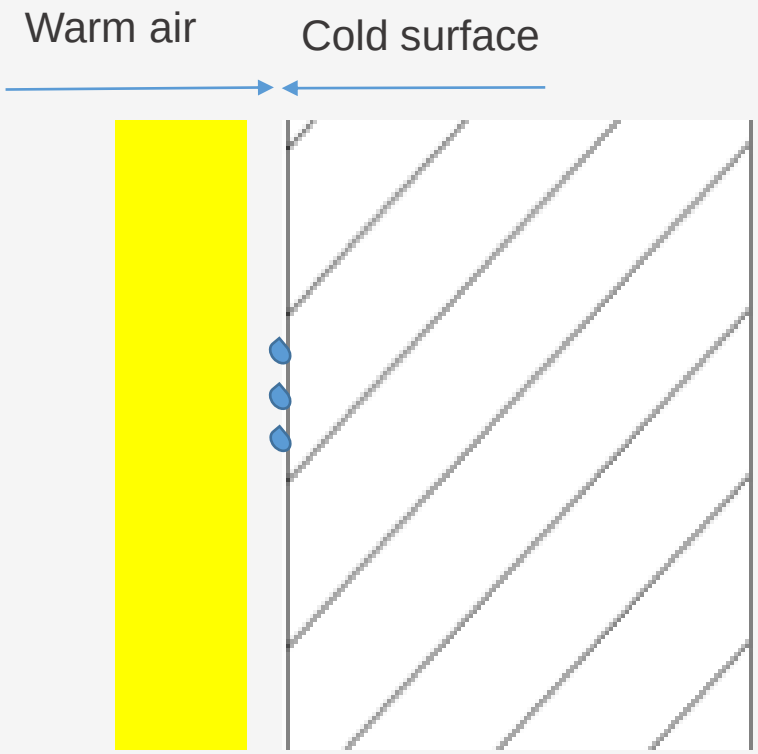
- External walls have to deal with this moisture movement
- When we introduce an internal insulation layer and start heating the internal air space we increase the moisture load.
- How the wall then continues to deal with these processes is critical
- So what are the consequences of using a material with either a high or low mu value?

Insulation types - High mu value



- Materials such as PIR / PUR / EPS / XPS have a high mu value. Typically in the region of 20 to 200 and beyond
- This means that they tend to block moisture from entering the fabric which can result in higher internal humidity levels
- The way the moisture moves through the fabric is changed
- But surely less moisture in the fabric is a good thing?

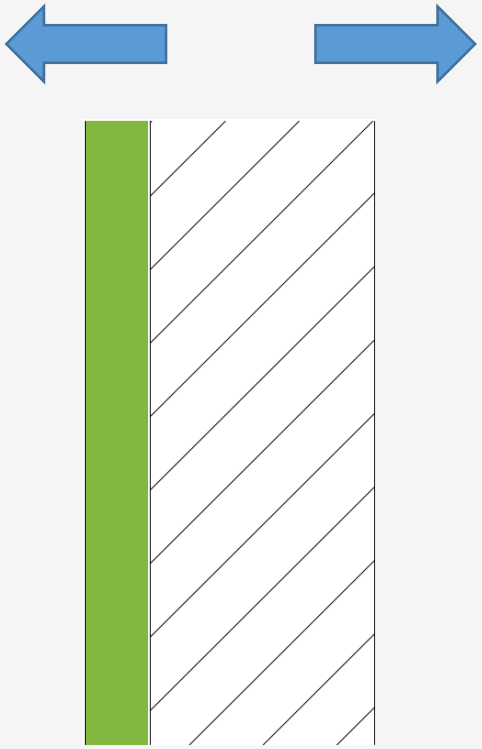
Insulation types - High mu value



- Standard U-value calculations will suggest that this is the best approach as moisture within the fabric is reduced.
- These types of systems are generally fitted to a frame or via a dot and dab plaster approach.
- This creates a cavity within the fabric where moisture can form.
- Any potential warm air that penetrates the insulation layer will reach the cold wall and condense. Liquid water is produced and can accumulate and become trapped within the fabric.

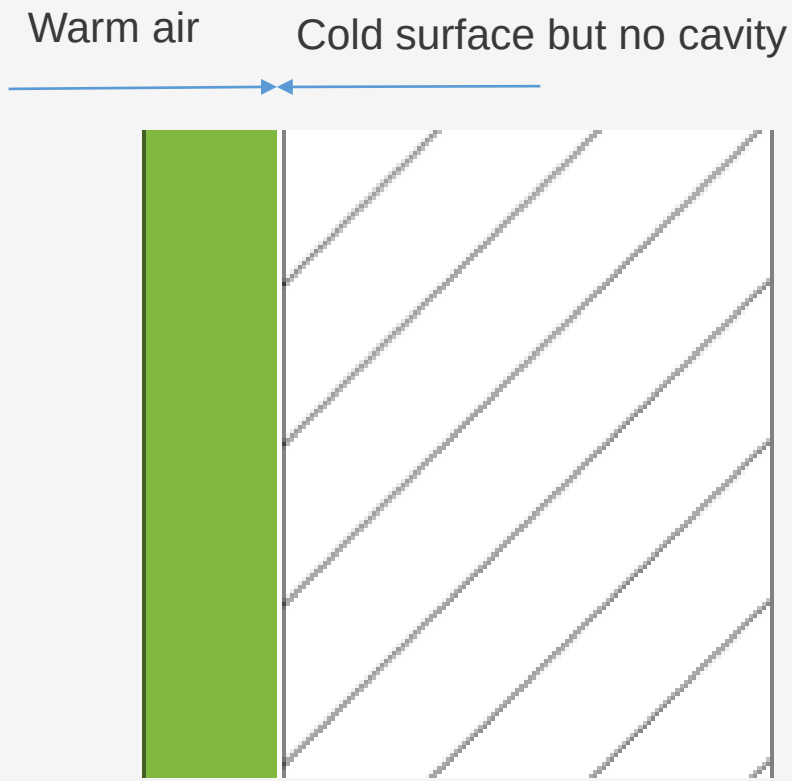
This can mean long term structural risk for brickwork or timber elements and the risk of mold forming and appearing on the inside of the wall surface

Insulation types – Low mu value



- Natural materials have low mu values in the region of 2 - 5
- This means that they can absorb water, store it at source and either release it back to the inside or pass it through to the fabric where it can then escape through the external face
- The way the moisture moves through the fabric is kept the same
- This ensures lower risk as liquid water can not accumulate

Insulation types – Low mu value



- Standard U-value calculations to not accurately asses the ability of materials to both absorb and evaporate moisture or its ability to pass water on through capillary action
- These types of systems are generally direct bonded with a lime or clay bonding coat
- This means no cavity for moisture to accumulate and hence lower risk of mold forming or condensation.

What’s the right insulation thickness?

Key points to consider:

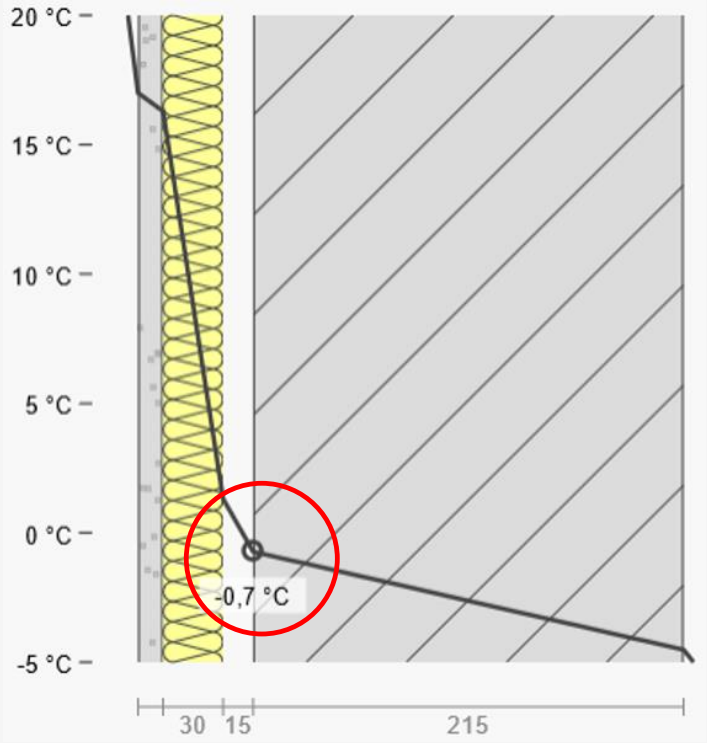
- The thicker the insulation layer the higher the moisture load and the colder the interface between the insulation layer and external wall becomes
- Typically the materials with the lowest thermal conductivity allow the thinnest insulation layer but these are typically those materials with high mu values
- There is a balance to be drawn between insulation thickness and type and how they are influenced by condensation risk

- Why does thickness increase condensation risk?

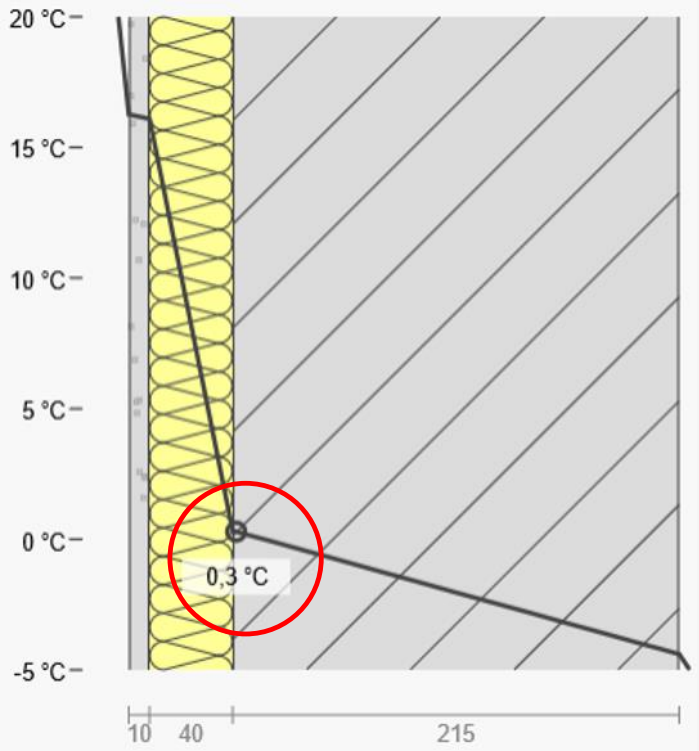
What’s the right insulation thickness?

Regardless of insulation type the interface between the insulation layer and the cold external wall surface is the area where condensation is most likely to form

High mu value



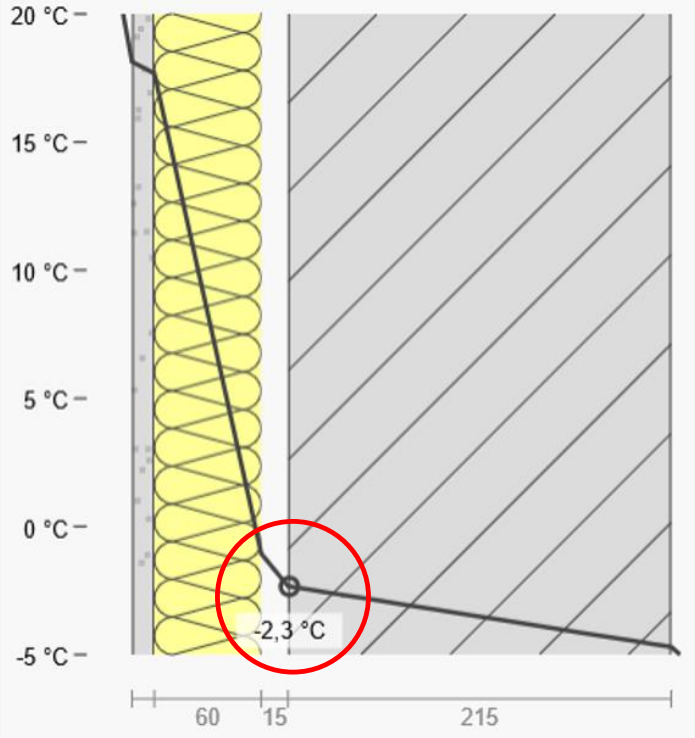
Low mu value



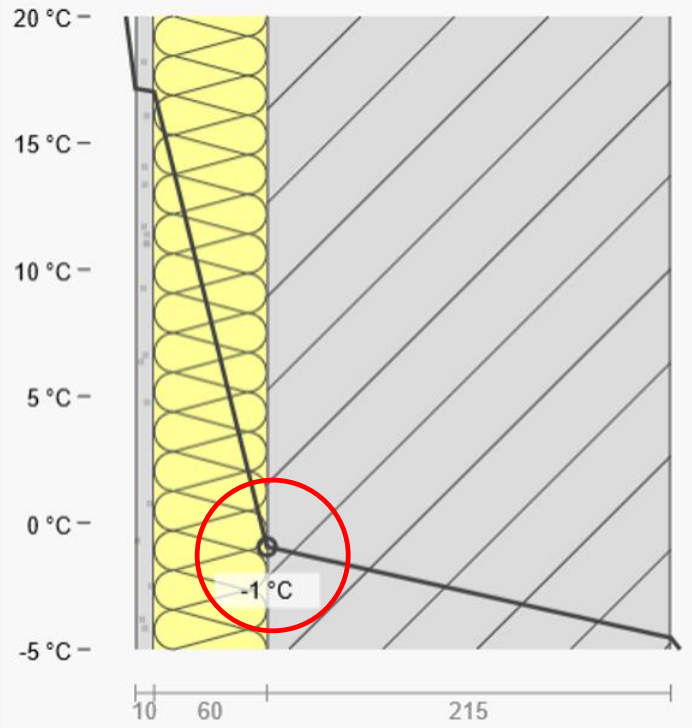
What’s the right insulation thickness?

The thicker the insulation layer the lower the temperature potential at this interface.

High mu value



Low mu value



What’s the right insulation thickness?

The simple answer is…...the minimum amount to achieve building regs compliance.

However the reality is that condensation risk / payback / thickness / affordability etc all paly a key role

- Materials with a low lambda value such as petro chemicals give the lowest U-value with the minimum thickness. However they have high mu values and the detailing and workmanship for these systems can increases condensation risk
- Natural materials have a higher lambda value and hence require greater thicknesses which we have seen can also increase condensation risk
- A balance has to be drawn between all the relevant issues and therefore more detailed analysis through programs such as WUFI can help the process. Being fully aware of al the relevant issues is key……. ……therefore

What’s the best approach?

Happy Reading !!!

A recent European study looked at the process of assessing existing buildings and then evaluating them in terms of façade renovations and internal insulation systems.

2.5 years of work……

…….its only 171 pages total !!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CORNET: IN2EUROBUILD - CONSISTENT EUROPEAN GUIDELINES FOR INTERNAL INSULATION OF BUILDING STOCK AND HERITAGE

Guideline part 1: **Building Assessment**

Project number: 247 EBG
Duration: 01.05.2019 to 31.12.2021

Dresden University of Technology
Institute for Building Climatology (IBK)

Fraunhofer IBP
Fraunhofer Institute for Building Physics
Holzkirchen (IBP)

Buildwise
Buildwise

IHD
Institute for Wood Technology Dresden (IHD)

30. November 2022


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CORNET: IN2EUROBUILD –

CONSISTENT EUROPEAN GUIDELINES FOR INTERNAL INSULATION OF BUILDING STOCK AND HERITAGE

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https://www.tihd-dresden.de/de/forschung/projekte/

What’s the best approach?

You don’t have to read it but it does highlight that Internal Insulation systems need careful consideration. There's a reason why loft insulation and cavity wall insulation is often targeted first because its seen as the easy option.

The latest energy efficiency details issued by the office for national Statistics detail the percentage of UK properties that have had insulation measures already installed.

- 66% of properties (with a loft) have loft insulation already installed
- 70% of properties (with a cavity) have cavity wall insulation already installed
- 9% of properties (with solid walls) have solid wall insulation[1]

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/970064/Detailed_Release_-_HEE_stats_18_Mar_2021_FINAL.pdf

There's plenty of potential for IWI but we need to make the right decision on the types and thicknesses of insulation that are appropriate for any given project.

Thank you

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