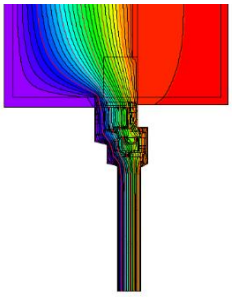
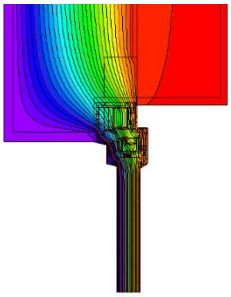
Extending Wall Insulation Over Window Frames – But What About Aluminium?

A proven Passive House strategy

In Passive House design, it's standard to extend external wall insulation over the top and sides of inward-opening windows (leaving the bottom exposed for drainage). This reduces the thermal bridge at the junction - often reducing the installation Psi-value (W/(mK)) to near or below zero. Even with windows installed in the structural layer, wrapping insulation around the frame still offers a thermal benefit. This effect can be seen in the thermal simulations below:



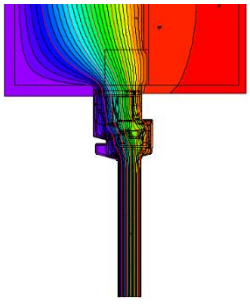
Ψ = 0,023 W/(mK)



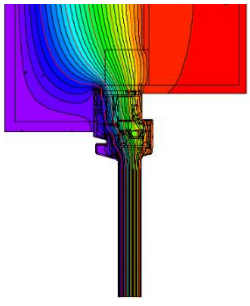
Ψ = 0,002 W/(mK)

Where it stops working: aluminium cladding

However, the benefit is greatly reduced when the frame uses aluminium cladding. In thermally broken aluminium, wood-aluminium, or PVC-aluminium frames, using full external aluminium covers will mean that heat is conducted from the warm inner wall to the cold exterior, greatly reducing the effect of the extended installation, as shown below:



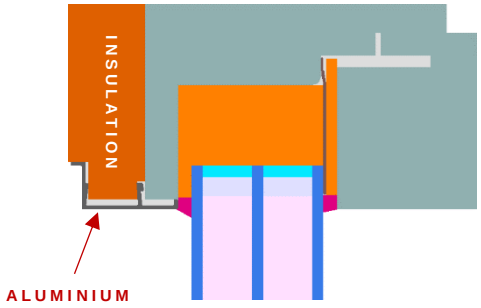
Ψ = 0,018 W/(mK)



Ψ = 0,016 W/(mK)

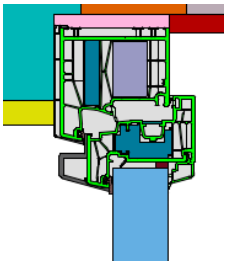
Optimising wood-aluminium frames

Some Passive House-standard wood-aluminium windows now use reduced cladding to the top and sides: aluminium only where it's visible. The remaining area is finished in exposed rigid insulation (e.g. wood fibre), greatly reducing the thermal bridging effect. You can see an example of this below:

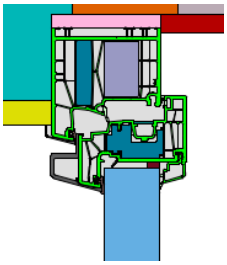


PVC-aluminium and full-aluminium options

PVC-aluminium frames can also benefit from 'shorter' aluminium covers. Though harder to redesign than wood frames, reducing the visible aluminium leaves exposed PVC, which performs better thermally. The biggest potential, however, lies with thermally broken aluminium frames. In their most common form, these use slim aluminium profiles connected via glass fibre-reinforced plastic (GFRP). By replacing the external aluminium profile at the top and sides with GFRP, the thermal bridge could be significantly reduced:



Ψ = 0,016 W/(mK)



Ψ = 0,009 W/(mK)

Call to action

The Passive House Institute encourages aluminium window frame manufacturers to prioritise thermal optimisation of installation details—particularly at the top and sides—for future research and development.

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