

Thermal Insulation: What It Is and Which Materials Define It

Thermal insulation is a structure's ability to hold interior temperature against outdoor variation. The choice of materials, measured by the conductivity coefficient, is the factor that decides that outcome.

Thermal insulation refers to a structure's ability to retain interior temperature against the difference in temperature with the outside. The purpose is clear: outdoor conditions, in both winter and summer, should not alter the comfort of the inhabited space.

How thermal insulation is measured

The technical term that describes this behaviour is the thermal conductivity coefficient, represented by the symbol λ . The materials used in construction are decisive in achieving a good coefficient: the lower the value of λ , the greater the material's insulating capacity. A high value means the material transmits heat easily; a low value means it retains it.

Interior comfort does not depend on the structure alone. The type of climate-control elements and their correct placement also contribute, and the combination of all these factors improves the overall energy efficiency. That efficiency translates into lower energy spending, and therefore into economic savings and reduced pollution. Even so, without a sound base structure, no climate-control system can offset the losses caused by temperature differences.

The conductivity of construction materials

The table below lists the thermal conductivity of common construction materials, expressed in λ values:

- Aluminium: 209.3 λ
- Steel: 47-58 λ
- Brick: 0.80 λ
- Concrete: 0.80 λ
- Glass: 0.6 λ
- Wood: 0.13 λ
- Wood fibre: 0.04 λ

- Glass fibre: 0.03 λ
- Cork: 0.03 λ
- Air: 0.02 λ

The reading is straightforward. Aluminium is a strong transmitter of temperature, whereas air, by contrast, is a good thermal insulator. Among the materials used as a structural base, the vast difference between brick or concrete and wood stands out: with a coefficient of 0.13 λ , wood holds the interior temperature far better.

Why wood and natural insulators make the difference

For its strength and its thermal coefficient, wood is an ideal material for building structures that are resistant and efficient at once. That said, the same table shows that even more insulating natural options exist, capable of raising a building's thermal performance. Such is the case with wood fibre and cork, both with values close to 0.03–0.04 λ , which allow the manufacture of panels with a great capacity to hold temperature.

At PAPIK Group we combine these materials to obtain the best result in high energy-efficiency construction, adapting to the technical advances that allow us to move towards the passive house standard, the Passivhaus. The aim is to achieve maximum comfort, savings and sustainability in every project, including when it comes to retrofitting existing buildings.

One factor among many

In high energy-efficiency construction, many other factors converge beyond thermal insulation. This article clarifies its foundation; in upcoming content we will address the remaining elements that define building efficiency.

A material's coefficient is no minor technical detail: it is the first decision that determines how much energy a house will consume across its entire service life.

Source: Wikipedia, Thermal conductivity.