Calculating U Values

Calculating U Values Jargon

To calculate U-values, you need to know about thermal conductivity, thermal resistance and thermal transmittance. So here's our simple guide to get you started:

Lambda (Thermal Conductivity)

Thermal conductivity (also known as Lambda) is the rate at which heat passes through a material, measured in watts per square metre of surface area for a temperature gradient of one kelvin for every metre thickness. This is expressed as W/mK. Thermal conductivity is not affected by the thickness of the product.
The lower the conductivity, the more thermally efficient a material is.
Example:
PIR Board: Lambda = 0.022 W/mK
Glass Fibre Roll: Lambda = 0.044 W/mK

R-Value (Thermal Resistance)

Thermal resistance is the ability of a material to prevent the passage of heat. It's the thickness of the material (in metres) divided by its conductivity. This is expressed as m2K/W.
If the material consists of several elements, the overall resistance is the total of the resistances of each element. The higher the R-value, the more efficient the insulation.
Example:
PIR Board: 0.022 W/mK and 100mm thick; R-value = 0.1 metres ÷ 0.022 = 4.54 m2K/W
Glass Fibre Roll: 0.044 W/mk and 100mm thick; R-value = 0.1 metres ÷ 0.044 = 2.27 m2K/W
N.B. Surfaces and cavities also provide thermal resistance which must be taken into account when calculating U-values. There are standard figures for the resistances of surfaces and cavities.

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U-Value (Thermal Transmittance)

Thermal transmittance, commonly known as the U-value, is a measure of the rate of heat loss of a building component. The U-value is the sum of the combined thermal resistances of all the elements in a construction, including surfaces, air spaces, and the effects of any thermal bridges, air gaps and fixings.
The U-value is expressed in watts per square metre, per degree kelvin, or W/m2K.

Calculating U Values

Start by calculating the thermal resistances of each element (R-values).
The R-value is the thickness of the product in metres ÷ Lambda (thermal conductivity).
Add the R-values of all materials used in the application (including any air gaps) and calculate the reciprocal. The reciprocal = 1 ÷ total of all R-values
Example:
PIR Board 0.022 W/mK100mm thick + Glass Fibre Roll 0.044 W/mK100mm thick
Total combined R-value = 4.54 + 2.27 = 6.81 m2K/W
U-value = 1 ÷ 6.81 = 0.147 W/m2K
N.B. The above example does not allow for any thermal bridges, air gaps and fixings etc. The lower the U-value, the more efficient the construction.

Calculating R Values

$$R = \frac{\text{THICKNESS IN METRES OF MATERIAL (MM ÷ 1000)}}{\text{THERMAL CONDUCTIVITY (LAMBDA VALUE } \lambda \text{ and k)}}$$

Thermal conductivity (Lambda) is a measure of thermal performance of a given material and is NOT related to thickness. The lower the Lambda the better the performance.
R-Value is a measure of thermal resistance. It considers the thermal conductivity of a product AND its thickness to measure thermal transfer through a material. The higher the R-Value the better the performance.
R-Values of each component in a structure are required to calculate the total resistance. (U-Value).

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