

Requirements

The requirements on the heat insulation of building components are stated in 'the Heat Insulation Regulation' according to **DIN 4108** (German Standard).

Calculation of the heat transition coefficient

Heat transmission resistance

The heat transmission resistance can be assumed as follows according to DIN 4108, Part 4:

$$\frac{1}{\alpha_i} = \frac{1}{\alpha_a} = 0,13 \frac{\text{m}^2 \text{ K}}{\text{W}}$$

Thermal resistance

The thermal resistance is strictly proportional to the thickness of the building component and is calculated as follows:

$$\frac{1}{\Lambda} = \frac{s}{\lambda_R} \left[\frac{\text{m}^2 \text{ K}}{\text{W}} \right]$$

s = thickness of the building component

λ_R = factor of the conductivity
(see table)

Heat transition resistance

The transition resistance of a building component is calculated by addition of the heat transmission resistances to the thermal resistance as follows:

$$\frac{1}{k} = \frac{1}{\alpha_i} + \frac{1}{\Lambda} + \frac{1}{\alpha_a} \left[\frac{\text{m}^2 \text{ K}}{\text{W}} \right]$$

Heat transition coefficient

The heat transition coefficient is equivalent to the reciprocal of the heat transition resistance and can be calculated as follows:

$$k = \frac{1}{\frac{1}{\alpha_i} + \frac{1}{\Lambda} + \frac{1}{\alpha_a}} \left[\frac{\text{W}}{\text{m}^2 \text{ K}} \right]$$

Calculation examples, Factors

The factors of conductivity of the applied materials are the basis of calculation as per the following table:

Material	Density	λ _R
	$\frac{\text{kg}}{\text{m}^3}$	$\frac{\text{W}}{\text{m K}}$
Soft Wood (Spruce)	ca. 450	0,13
Particle Board (FPY)	ca. 700	0,13
Hard Fibre Board	ca. 1000	0,17
Soft Fibre Board	ca. 300	0,06
Tubeboard with 55% solid content	ca. 500	0,10

The heat transition coefficient 'k' of a door blank with a Tubeboard core can be calculated as follows:

Thickness of door blank = 40 mm = 0,04 m

Conductivity λ_R about. 0,12 $\frac{\text{W}}{\text{m K}}$
(calculated, as multilayered)

$$\frac{1}{\Lambda} = \frac{0,04}{0,12} = 0,33 \frac{\text{m}^2 \text{ K}}{\text{W}}$$

Heat transmission resistances

$$\frac{1}{\alpha_i} = \frac{1}{\alpha_a} = 0,13 \frac{\text{m}^2 \text{ K}}{\text{W}}$$

$$\frac{1}{k} = 0,13 + 0,33 + 0,13 = 0,59 \frac{\text{m}^2 \text{ K}}{\text{W}}$$

$$k = \frac{1}{0,13 + 0,33 + 0,13} = 1,69 \frac{\text{W}}{\text{m}^2 \text{ K}}$$

Result

The k-value of a 40mm thick door blank made of wooden materials meets the minimum requirements on flat entrance doors according to DIN 4108, Part 1:

$$k = 1,69 \frac{\text{W}}{\text{m}^2 \text{ K}}$$