$\sin\theta = \theta - \frac{\theta^3}{3!} + \frac{\theta^5}{5!} - \frac{\theta^7}{7!} + \cdots$ $E_b = \sigma T^4$

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$e^{i\pi} = -1$ $\frac{u}{u_\tau} = \frac{1}{\kappa}\ln\frac{yu_\tau}{\nu} + C$

USER GUIDE

Vapour Resistance Units Converter Web Application

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22 September 2020

Atkinson Science welcomes your comments on this User Guide. Please send an email to keith.atkinson@atkinsonscience.co.uk.

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1 Introduction

You can find the Atkinson Science Vapour Resistance Units Converter web application at the web address https://atkinsonscience.co.uk/WebApps/Construction/VapResUnitsConverter.aspx.

Most building materials have open pores containing stationary air. If there is a difference in vapour concentration across a layer of material, then vapour will diffuse through the stationary air in the direction from high concentration to low concentration. The mass flux of vapour is usually modelled by

$$m_v = -\frac{1}{10^6 \zeta}\frac{dp_v}{dx}$$

where m_v [g s^{-1} m^{-2}] is the mass flux of vapour (mass flow rate of vapour per unit area), ζ [MN s g^{-1} m^{-1}] is the vapour resistivity, p_v [Pa] is the pressure of the vapour in the mixture of air and vapour, and x [m] is the direction of diffusion. The negative sign appears because the diffusion of vapour is in the direction of decreasing vapour pressure. The vapour resistivity ζ is a material property, independent of the thickness of the material.

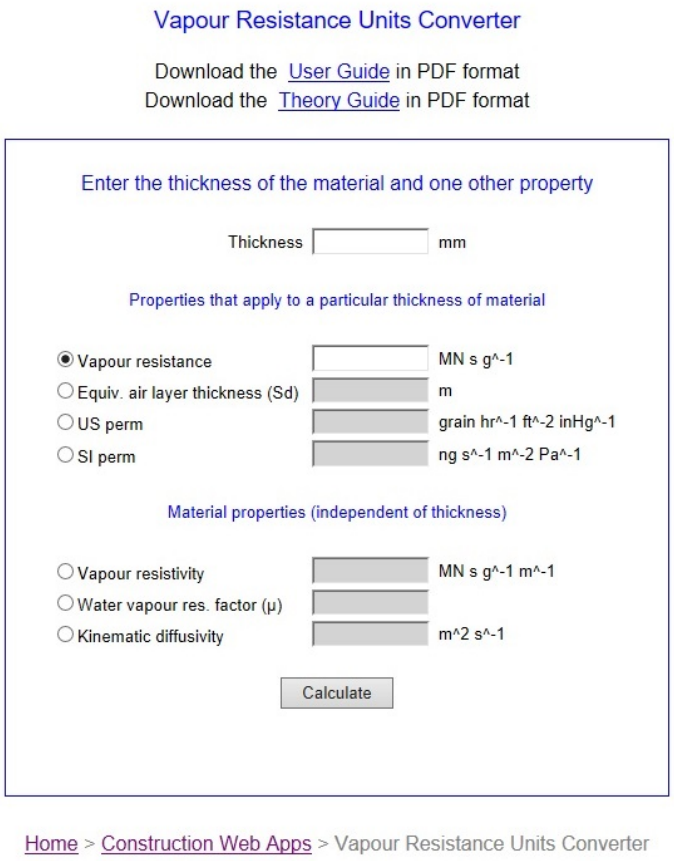
The vapour resistivity is just one set of units by which the resistance to the diffusion of vapour through a material is measured. Some of the different sets of units are material properties, like the vapour resistivity, while others apply to a given thickness of material. There are also sets of units for the permeability of the material to the diffusion of vapour. These are inversely proportional to the resistivity of the material.

The Vapour Resistance Units Converter is a web application that enables the user to convert from one set of units of vapour resistance or permeability to another. This guide provides instructions on how to use the application. The relationships between the different sets of units are explained in the document *Vapour Resistance Units Converter Web Application Theory Guide*, 22 September 2020, which can be downloaded from the Atkinson Science web site https://atkinsonscience.co.uk.

2 Using the units converter

The user interface of the Vapour Resistance Units Converter is shown in Figure 1.

Figure 1 User interface of the Vapour Resistance Units Converter



The user must enter the thickness in millimetres of the material in the Thickness text box. Then the user must click the radio button for the units to be converted and enter the value of the units in the corresponding text box. When the user clicks the Calculate button the values of all the other units will be displayed in the text boxes. The units are grouped into those that apply only to the specified thickness of material and those that represent material properties and are independent of the thickness of the material. Figure 1 shows the values that are displayed when the user has entered a thickness of 20 mm and then selected the vapour resistance as the units to be converted and entered a value of 50 M N s g^{-1} for the units.

The vapour resistance, equivalent air layer thickness, vapour resistivity and water vapour resistance factor are all measures of the resistance of the material to the diffusion of vapour. The US perm, SI perm and kinematic diffusion are all measures of the permeability of the material. The vapour permeability is inversely proportional to the vapour resistance, and the values of the latter three sets of units will decrease as the other four increase.