

Formulae used to Calculate Results

A.1. Calculation of air leakage rate

Subtract the average zero flow pressure difference (offset) from each of the measured pressure differences, Δp_m , to obtain the induced pressure differences, Δp , using Equation (1)

$$\Delta p_{env} = \Delta p_m - \frac{\Delta p_{0.1} + \Delta p_{0.2}}{2} \quad (1)$$

The air density, ρ , kg/m³, at a temperature, θ , in °C, and the barometric pressure, p_{bar} , in Pa can be obtained using the following:

$$\rho = \frac{p_{bar} - 0.37802 p_v}{287.055 (\theta + 273.15)} \quad (2)$$

Where p_v is the partial water vapour, and ϕ is the Relative Humidity (%) in air, and can be calculated using Equation (3):

$$p_v = \phi \cdot \exp \left\{ 59.484085 - \left(\frac{6,790.4985}{\theta + 273.15} \right) - (5.02802 \times \ln(\theta + 273.15)) \right\} \quad (3)$$

Convert the measured flow rate, Q_m , to airflow through the building envelope, Q_{env} :

a) For Pressurisation, use equation:
$$Q_{env(out)} = Q_m \left(\frac{\rho_e}{\rho_i} \right) \quad (4)$$

b) For Depressurisation, use equation:
$$Q_{env(in)} = Q_m \left(\frac{\rho_i}{\rho_e} \right) \quad (5)$$

where:

ρ_e is the external air density (kg/m³), and ρ_i is the internal air density (kg/m³)

The air flow rates and corresponding pressure differentials are plotted on a log-log graph. The plotted data is then used to determine the air flow coefficient, C_{env} , and the air flow exponent, n , in accordance with equation (6), using a least squares technique.

$$Q_{env} = C_{env} (\Delta p)^n \quad (6)$$

To calculate the air leakage coefficient C_L , the air flow coefficient C_{env} is corrected to standard atmospheric conditions using equation (7) or (8)

a) For Pressurisation, use equation:
$$C_L = C_{env} \left(\frac{\rho_i}{\rho_s} \right)^{1-n} \quad (7)$$

b) For Depressurisation, use equation:
$$C_L = C_{env} \left(\frac{\rho_e}{\rho_s} \right)^{1-n} \quad (8)$$

where:

C_L is the air leakage coefficient (m³/(hr.Paⁿ), C_{env} is the air flow coefficient (m³/(hr.Paⁿ) determined from equation (6), ρ_s is the standard air density (kg/m³), and n is the flow exponent determined from equation (6)

The leakage rate, Q_L , can then be calculated using equation (9).

$$Q_L = C_L (\Delta p_{env})^n \quad (9)$$

where:

Δp is the induced pressure differential (Pa), corrected in equation (1)

A.2. Calculating Air permeability at reference pressure

The air permeability at the reference pressure (usually designated at 50 Pa, and denoted by the subscript), Q_{50} , is calculated by division of the mean air leakage rate at the reference pressure by the envelope area, A_E , as seen in equation (10).

$$Q_{50} = \frac{V_{50}}{A_E} \quad (10)$$