

Airflow

We are generally interested in the amount of air that is moved. It could be because regulations call for so many changes per hour, for example regulations advise that offices should have four to six changes per hour. Alternatively a machine needs to be cooled and therefore requires a particular volume of air to remove heat to keep it cool.



Volume flow is measured in the following units:

M³/h metres cubed per hour

M³/s meters cubed per second

cfm cubic feet per minute

l/s litres per second

General ventilation

The air volume can be calculated from the required number of air changes per hour for a particular room. For example: it is recommended to have four to six changes per hour in an office. If the room is 10 metres x 10 metres x 3 metres high, then the required airflow rate is:

$(10 \times 10 \times 3) \times 6$ changes per hour = 1800m³/h.

Volume required to dissipate heat

The volume of air required to remove heat from a system can be calculated given a number of parameters. The equation to use is as follows:

$$V = Q \times 3600$$

$$\rho \times C_p \times \Delta t$$

$$V = \text{Volume flow m}^3/\text{h}$$

$$Q = \text{Heat energy in W.}$$

$$\rho = \text{Density of Air } 1.2256 \text{ kg/m}^3$$

$$c_p = \text{Specific heat capacity for air } 1005 \text{ J/kg/K.}$$

$$\Delta t = \text{Difference between ambient and maximum temperature.}$$

For example a box has a heat source of 3 kW and the temperature of the ambient incoming air is 30°C. The weakest component in the box cannot withstand more than 50°C.

The maximum allowable temperature rise Δt is the maximum temperature minus ambient temperature, which is 50°C . 30°C that equals 20°C. Using the above equation, we have

$$\frac{3000 \times 3600}{1.2256 \times 1005 \times 20} = 438 \text{ m}^3/\text{h.}$$