

METHODS OF CALCULATING MINIMUM FRESH AIR REQUIREMENTS

Job outline

Sam from Fresh or Freezing has been asked to complete work on the air conditioning system for an office computer room at the Gateway Complex.

The room is approximately 10m x 10m x 2.4m high and requires the ventilation supplied to meet AS/NZS 1668.

Sam can use any of the following methods.

METHOD 1 – AIR CHANGE RATE

Tables are available recommending minimum air change rates per volume of space. The following formula is used when using air change rates:

$$\text{Quantity of fresh air required (L/s)} = \frac{\text{Air change rate (changes per hr)} \times \text{Room volume (m}^3\text{)} \times 1000}{3600}$$

Note: $\frac{1000}{3600}$ is required to bring m³/hr to L/s

Example:

Calculate the ventilation requirements for the office computer room in the main example above if the air change rate was specified to be 2 changes per hour.

Solution:

$$\text{Quantity of air} = \frac{2(\text{changes per hour}) \times 10\text{m} \times 10\text{m} \times 2.4\text{m} \times 1000}{3600}$$

$$\text{Quantity of air} = 133 \text{ L/s}$$

METHOD 2 – UNKNOWN OCCUPANCY

Example:

If the occupancy of the building is unknown but if it has a particular application, such as an office computer room, then the fresh air requirements can still be calculated. To do this we use tables which estimate the floor area per person (m²) for different uses of a building and the fresh air requirement per person (L/s) for that use. For specialised uses the tables will estimate the fresh air requirement in L/s per m².

Solution:

For the example above the fresh air requirement would be:

Step 1

Occupancy rate = Floor area (m²)/Floor area per person (m²)

For an office computer room, the figure for this application would be 25m². This means that for every 25m² of floor area, one person is assumed to be present for the purpose of the fresh air calculation. Therefore:

Occupancy rate = 10m x 10m (100m²)/25m²

Occupancy rate = 4 people

Step 2

Quantity of air (L/s) = Occupancy rate x Rate/person (L/s per person)

For an office computer room, the quantity per person would be 10 L/s.

Quantity of air = 4 people (from step 1) x 10 L/s

Quantity of air = 40 L/s

Another way of simplifying the above steps would be to combine the two formulas of step 1 and 2:

Quantity of air (L/s) = $\frac{\text{Floor area (m}^2\text{)} \times \text{Rate per person (L/s)}}{\text{Floor area per person (m}^2\text{ per person)}}$

METHOD 3 – KNOWN OCCUPANCY

If the occupancy of the building is known to be higher than the number calculated per floor area, then this number must be used to determine the minimum rate.

Example:

If five people were known to be using the computer room on a regular basis, the ventilation rate would be:

Quantity of air (L/s) = Known occupancy rate x Rate/person (L/s)

Solution:

Quantity of air = 5 people x 10 L/s (same as previous example)

Quantity of air = 50 L/s

The higher of the fresh air quantities calculated in methods 1 to 3 must be used for the given application. In this instance the fresh air requirements for the office computer room would be 133 L/s.

Care must be taken when using these tables to ensure that the correct unit is used. For some specialised uses the quantity listed is L/s per m² not per person.

Example:

A veterinary centre has an animal reception area and animal stalls which require 10 L/s of fresh air per m².

The combined area of the animal reception area and stalls is:

(5m x 8m) + (15m X 15m) = 265m², therefore 2650 L/s of fresh air is required (265m² x 10 L/s).

The office area is: 12m x 8m = 96m²

Solution:

Assume the occupancy rate for office areas is 10m² per person and 10 L/s is required for each person.

Occupancy rate for the office space:

$$\frac{96\text{m}^2 \text{ (net floor area per person)}}{10\text{m}^2 \text{ per person}} = 9.6 \text{ people (use 10)}$$

However, the actual number of people is 12, so this figure must be used.

Quantity of air: 12 people x 10 L/s per person = 120 L/s

It would be unwise in this application to use a common system for both areas regardless of whether the system was a pressurising supply air system or an exhaust system that included fresh air from outside.

The better alternative in this case is a supply system to filter the air entering the office and pressurise the space, and an extraction system for the animal areas to induce the required air into the space.