

Air Changes Per Hour

Oxycom Fresh Air BV*

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Abstract

An HVAC system is usually dimensioned based on the heat load of the space that requires cooling. But the required ventilation needs, depending on both application and occupation, are often overlooked. A simple air change calculation may assist in finding the right amount of fresh air ventilation.

1 Company overview

Oxycom is a Dutch company specialized in the development and production of products and components for adiabatic cooling, indirect evaporative cooling, dew point cooling, air humidification and heat recovery.

Oxycom developed, engineered and manufactures the Oxycell Indirect Evaporative Heat Exchanger and the Oxyvap Direct Evaporative Cooling pad.

The Oxycell is the base of highly efficient all season fresh air systems that provide dew point cooling, indirect evaporative cooling, heat recovery and ventilation. The Oxyvap is the base of highly efficient cooling-only systems that provide direct evaporative cooling, humidification and ventilation.

2 Air changes per hour

2.1 Definitions

An air change is the process of replacing stale indoor air with fresh outdoor air. The air change rate or air changes per hour (*ACH*) provides the number of times that the entire volume of the conditioned space is replaced by fresh outdoor air in one hour.

2.2 Simple calculation

- Use the table below to find the required amount of air changes per hour.
- Calculate the volume of the space to be conditioned in either m³ (for SI units) or in ft³ (for I-P units).
- Calculate the required airflow:

$$\text{Air flow [m}^3/\text{h]} = \text{Volume [m}^3] \times \text{ACH [h}^{-1}\text{]}$$

$$\text{Air flow [CFM]} = \frac{\text{Volume [ft}^3] \times \text{ACH [h}^{-1}\text{]}}{60 \text{ [min/h]}}$$

3 Air changes table

The table below shows the required air change rate values based on data from The Engineering Toolbox [1], Nuaire [2] and Technisch Adviesbureau Betuwe [3].

Application	<i>ACH</i> [h ⁻¹]
All spaces in general	≥ 4
Assembly halls	4–6
Attic spaces for cooling	12–15
Auditorium	8–15
Bakeries	20–30
Banks	4–10
Barber shops	6–10
Bars	20–30
Bathrooms	15–20
Beauty shops	6–10
Boiler rooms	15–20
Bowling alleys	10–15
Cafeterias	12–15
Cellars	4–10
Changing rooms	6–10
Churches	8–15
Cinemas	6–10
Classrooms	6–20

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Application	ACH [h ⁻¹]
Club rooms	12
Clubhouses	20–30
Cocktail lounges	20–30
Computer rooms	15–20
Conference rooms	8–10
Court houses	4–10
Dance halls	10–12
Dark rooms	10–12
Dental centers	12–15
Department stores	6–10
Dining halls	12–15
Dress shops	6–10
Drug shops	6–10
Engine rooms	4–6
Entrance halls	4–5
Factory, ordinary	4
Factory, fumes/moisture	10–15
Fire stations	4–10
Foundries	15–20
Galvanizing plants	20–30
Garages, repair	20–30
Garages, storage	6–10
Gymnasiums	6–8
Homes, night cooling	10–18
Hospital rooms	6–8
Jewelry shops	6–10
Kitchens	15–60
Laundries	10–15
Libraries	4
Lunchrooms/luncheonettes	10–15
Machine shops	6–12
Malls	6–10
Medical centers/clinics/offices	8–12
Mills, paper	15–20
Mills, textile general buildings	4
Mills, textile dye houses	15–20
Municipal buildings	4–10
Museums	12–15
Nightclubs	20–30
Offices	4–6
Photo dark rooms	10–15
Pig houses	6–10
Police stations	4–10
Post offices	4–10
Poultry houses	6–10
Precision manufacturing	10–50
Pump rooms	5
Residences	4

Application	ACH [h ⁻¹]
Restaurants	10–15
Retail	6–10
Shoe shops	6–10
Shopping centers	6–10
Shops, machine	5
Shops, paint	15–20
Shops, woodworking	5
Showers	15–20
Substation, electric	5–10
Supermarkets	8–10
Swimming pools	20–30
Town halls	4–10
Taverns	20–30
Theaters	8–15
Toilets, public	6–8
Transformer rooms	10–30
Turbine rooms, electric	5–10
Utility rooms	15–20
Warehouses	6–30
Waiting rooms, public	4
Workshops	8–10

References

- [1] The Engineering Toolbox, Air Change Rates in typical Rooms and Buildings, https://www.engineeringtoolbox.com/air-change-rate-room-d_867.html.
- [2] Nuair Limited, Commercial Useful Information, 029 2085 8200 (2011).
- [3] Technisch Adviesbureau Betuwe, Richtlijnen Tabellen Ventilatietechniek.