Ventilation Rate from CO_2 Concentration (Mass Balance)

Outdoor air needed to hold a room's CO_2 at a limit from the number of people and their CO_2 generation, or the steady CO_2 for a given flow.

Method: Steady-state mass balance V = n G/(C_i − C_o)

Input parameters

Unit system: SI

Parameter	Value	Unit
Number of people	25.000	
CO_2 generation per person Depends on activity; your handbook's figure (about 0.005 L/s for office work).	0.005200	L/s
Indoor CO_2 limit (ppm)	1,000.0	
Outdoor CO_2 (ppm)	420.00	
Actual outdoor air flow (for the steady level)	200.00	L/s

Calculated results

Parameter	Value	Unit
Outdoor air needed	224.14	L/s
Per person	8.9655	L/s
Steady CO_2 with the actual flow (ppm)	1,070.0	

Notes for this case

- Steady-state mass balance with perfect mixing; CO_2 shows occupancy, not every pollutant.

Formula and method

$$\dot{V} = \frac{nG}{(C_i - C_o) \times 10^{-6}}$$

Variables

n	Number of people	-
G	CO_2 generation per person	m³/s
C_i	Indoor CO_2 limit (ppm)	-
C_o	Outdoor CO_2 (ppm)	-
$\dot{V}_a$	Actual outdoor air flow (for the steady level)	m³/s
$\dot{V}$	Outdoor air needed	m³/s
$\dot{V}/n$	Per person	m³/s
C_{ss}	Steady CO_2 with the actual flow (ppm)	-

Method and standards

Mass balance.

Assumptions and limits

- Perfect mixing, steady state.
- The steady CO_2 is shown only for an actual flow above zero.

References

- Steady-state mass balance V = n G/(C_i − C_o)

Report details

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Release checks	2 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/hvac/loads/co2-ventilation-rate

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.