Clean Room Air Flow for a Particle Class

Supply air flow and air changes a clean room needs to hold its ISO 14644-1 class concentration against particle generation from people and processes.

Method: ISO 14644-1 class formula C_n = 10^N(0.1/D)^2.08; steady well-mixed particle balance (ASHRAE Handbook—HVAC Applications (2019), ch. 19)

Input parameters

Unit system: SI

Parameter	Value	Unit
ISO class number	7.0000	
Particle size considered	0.50000	µm
Particles per person per second (≥ D)	100,000	
People in the room	4.0000	
Other generation (particles/s)	10,000	
Supply air concentration (particles/m³)	0	
Ventilation effectiveness	80.000	%
Room volume	300.00	m³

Calculated results

Parameter	Value	Unit
Class limit (particles/m³)	351,676	
Total generation (particles/s)	410,000	
Supply air flow	5,246.3	m³/h
Air changes per hour	17.488	

Notes for this case

- Class limit from the ISO 14644-1 formula C_n = 10^N(0.1/D)^2.08 (D in µm). Steady mixing model; designers usually apply a safety factor of 2 or more and check recovery time. Unidirectional (laminar) rooms are sized by velocity, not by this model.

Formula and method

$$C_n = 10^N \left(\frac{0.1}{D}\right)^{2.08}, \quad \dot{V} = \frac{G}{\varepsilon_v (C_n - C_s)}$$

Variables

N	ISO class number	-
D	Particle size considered	m
g_p	Particles per person per second (≥ D)	-
n	People in the room	-
G_o	Other generation (particles/s)	-
C_s	Supply air concentration (particles/m³)	-
ε_v	Ventilation effectiveness	-
V	Room volume	m³
C_n	Class limit (particles/m³)	-
G	Total generation (particles/s)	-
$\dot{V}$	Supply air flow	m³/s
ACH	Air changes per hour	-

Method and standards

Particle balance.

Assumptions and limits

- Non-unidirectional (mixed) flow; steady state.
- No safety factor is applied: the flow holds the room exactly at the class limit. Multiply by your design factor (often 2 or more).

References

• ISO 14644-1 class formula C_n = 10^N(0.1/D)^2.08; steady well-mixed particle balance (ASHRAE Handbook—HVAC Applications (2019), ch. 19)

Report details

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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/cleanroom-air-changes

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.