Room Pressurisation: Leakage Air Flow

Air leaking through gaps from a room held at a pressure difference (control rooms, clean rooms), from leakage area and discharge coefficient.

Method: ASHRAE Handbook—Fundamentals (2017); ch. 16 (orifice equation for leakage); ASHRAE Handbook—HVAC Applications (2019); ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Total leakage area	0.050000	m²
Pressure difference	15.000	Pa
Discharge coefficient	0.61000	
Air density	1.2000	kg/m³
Room volume	200.00	m³

Calculated results

Parameter	Value	Unit
Leakage air flow	549.00	m³/h
Leakage as air changes per hour	2.7450	
Ideal jet velocity through the gaps √(2Δp/ρ)	5.0000	m/s

Notes for this case

• Orifice flow through door gaps, cable openings and joints. Supply must exceed exhaust by this flow to hold the pressure; add 10–20 % margin. Door opening breaks the pressure briefly.

Formula and method

$$v = \sqrt{\frac{2\Delta p}{\rho}}, \quad \dot{V} = C_d A_L v, \quad ACH = \frac{3600\,\dot{V}}{V}$$

Variables

A_L	Total leakage area	m²
Δp	Pressure difference	Pa
C_d	Discharge coefficient	-
ρ	Air density	kg/m³
V	Room volume	m³
$\dot{V}$	Leakage air flow	m³/s
ACH	Leakage as air changes per hour	-
v	Ideal jet velocity through the gaps	m/s

Method and standards

Orifice equation.

Assumptions and limits

- Orifice flow; constant density.
- v is the ideal (vena contracta) jet velocity; the mean velocity over the leakage area A_L is C_d v.

References

• ASHRAE Handbook—Fundamentals (2017)
• ch. 16 (orifice equation for leakage); ASHRAE Handbook—HVAC Applications (2019)

- ch. 19 (clean spaces)

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/room-pressurisation-leakage

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.