Dehumidifier Capacity and Air Flow for a Moisture Load

Dry-air and volume flow a dehumidifier needs to remove a moisture load, from room conditions and supply humidity ratio, with latent capacity.

Method: ASHRAE Handbook—Fundamentals (2017); ch. 1 (moisture balance)

Input parameters

Unit system: SI

Parameter	Value	Unit
Moisture load	10.000	kg/h
Room temperature	30.000	°C
Room relative humidity to hold	55.000	%
Supply air humidity ratio	8.0000	g/kg
Barometric pressure	101.33	kPa

Calculated results

Parameter	Value	Unit
Room humidity ratio	14.675	g/kg
Dry air flow	0.41616	kg/s
Air flow at room conditions	1,317.0	m³/h
Latent capacity (at 2 501 kJ/kg, the psychrometric convention)	6.9472	kW

Notes for this case

• Moisture balance ṁ_a(W_r − W_s) = ṁ_w. Latent capacity at 2,501 kJ/kg. Desiccant units reach very low W_s; refrigerant coils are limited by their dew point.

Formula and method

$$\dot{m}_a = \frac{\dot{m}_w}{W_r - W_s}, \quad Q_l = \dot{m}_w h_{fg}$$

Variables

$\dot{m}_w$	Moisture load	kg/s
t_r	Room temperature	K
φ_r	Room relative humidity to hold	-
W_s	Supply air humidity ratio	kg/kg
p	Barometric pressure	Pa
W_r	Room humidity ratio	kg/kg
$\dot{m}_a$	Dry air flow	kg/s
$\dot{V}$	Air flow at room conditions	m³/s
Q_l	Latent capacity (at 2 501 kJ/kg, the psychrometric convention)	W

Method and standards

Moisture balance.

Assumptions and limits

- Steady state; well-mixed room.
- Latent capacity at h_fg = 2 501 kJ/kg, the latent heat at 0 °C used in psychrometric load formulas; the condensation enthalpy at room temperature is about 2 % lower (about 2 430 kJ/kg at 30 °C).

References

• ASHRAE Handbook—Fundamentals (2017)

- ch. 1 (moisture balance)

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/psychrometry/dehumidifier-capacity

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.