Mixing of Two Air Streams (Psychrometric)

Temperature, humidity and enthalpy of the mixture of two moist-air streams, such as fresh and return air, by mass and energy balance on dry air.

Method: ASHRAE Handbook—Fundamentals ch. 1 Psychrometrics; IAPWS-IF97 saturation pressure

Input parameters

Unit system: SI

Parameter	Value	Unit
Stream 1 volume flow (at its own state)	2,000.0	m³/h
Stream 1 dry bulb	35.000	°C
Stream 1 relative humidity	60.000	%
Stream 2 volume flow (at its own state)	8,000.0	m³/h
Stream 2 dry bulb	24.000	°C
Stream 2 relative humidity	50.000	%
Barometric pressure (absolute)	101.33	kPa

Calculated results

Parameter	Value	Unit
Mixed air dry bulb	26.142	°C
Mixed air relative humidity	54.802	%
Mixed air humidity ratio	11.623	g/kg
Mixed air enthalpy per kg of dry air	55.932	kJ/kg
Total dry-air mass flow	11,578	kg/h
Share of stream 1 in the dry air	19.128	%

Formula and method

$$\dot{m}_{da,i} = \frac{\dot{V}_i}{v_i} \qquad W_m = \frac{\sum \dot{m}_{da,i} W_i}{\sum \dot{m}_{da,i}} \qquad h_m = \frac{\sum \dot{m}_{da,i} h_i}{\sum \dot{m}_{da,i}}$$

$$t_m = \frac{h_m - 2\,501\,000\, W_m}{1006 + 1860\, W_m}$$

Variables

$\dot{V}_1$	stream 1 volume flow	m³/s
T_1	stream 1 dry bulb	K
φ_1	stream 1 RH	–
$\dot{V}_2$	stream 2 volume flow	m³/s
T_2	stream 2 dry bulb	K
φ_2	stream 2 RH	–
p	barometric pressure	Pa
T_m	mixed dry bulb (t_m in °C)	K
φ_m	mixed RH	–
W_m	mixed humidity ratio	kg/kg
h_m	mixed enthalpy	J/kg
$\dot{m}_{da}$	dry-air mass flow	kg/s

x_1	stream 1 share of dry air	–
v_i	specific volume per kg dry air	m³/kg

Method and standards

Adiabatic mixing of moist air on a dry-air basis (ASHRAE Handbook—Fundamentals ch. 1); properties of each stream as in the psychrometric calculator.

Assumptions and limits

- Steady flow, no heat exchange with the duct; pressure the same for both streams.

References

• ASHRAE Handbook—Fundamentals ch. 1 Psychrometrics
• IAPWS-IF97 saturation pressure

Report details

Report reference	FCC-2WBZ-QG8Y (the same inputs always give the same reference)
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Calculator	Mixing of Two Air Streams (Psychrometric)
Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 November 2026
Release checks	3 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/air-stream-mixing

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.