Evaporative Cooler Outlet Temperature

Air leaving a direct evaporative cooler or air washer from the inlet dry bulb, humidity and saturation efficiency, with outlet humidity and water evaporated.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Inlet dry bulb	40.000	°C
Inlet relative humidity	25.000	%
Saturation efficiency of the pad or washer From the cooler maker; depends on pad depth and face velocity.	85.000	%
Air flow (at the inlet state)	10,000	m³/h
Barometric pressure (absolute)	101.33	kPa

Calculated results

Parameter	Value	Unit
Outlet dry bulb	26.066	°C
Outlet relative humidity	80.557	%
Inlet wet bulb	23.607	°C
Outlet humidity ratio	17.157	g/kg
Water evaporated	62.149	kg/h

Notes for this case

- The process is taken at constant enthalpy (adiabatic saturation); pump heat and make-up water temperature are neglected.

Formula and method

$$T_2 = T_1 - \varepsilon\,(T_1 - T_{wb}) \qquad h_2 = h_1 \qquad W_2 = \frac{h_1 - 1006\,t_2}{2\,501\,000 + 1860\,t_2} \qquad \dot{m}_w = \dot{m}_{da}(W_2 - W_1)$$

Variables

T_1	inlet dry bulb	K
φ_1	inlet RH	–
ε	saturation efficiency	–
$\dot{V}$	air flow at inlet	m³/s
p	barometric pressure	Pa
T_2	outlet dry bulb (t_2 in °C)	K
φ_2	outlet RH	–
T_{wb}	inlet wet bulb	K
W_2	outlet humidity ratio	kg/kg
$\dot{m}_w$	water evaporated	kg/s
h_1	inlet enthalpy	J/kg
$\dot{m}_{da}$	dry-air flow	kg/s

Method and standards

Direct evaporative cooling follows the wet-bulb line at nearly constant enthalpy; the saturation (wet-bulb) efficiency sets how close the outlet comes to the wet bulb. Moist-air relations from ASHRAE ch. 1.

Assumptions and limits

- Constant enthalpy; pump heat and make-up water temperature neglected.

References

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

Report details

Report reference	FCC-8NJZ-A7QH (the same inputs always give the same reference)
Generated	17 November 2026, 19:36 UTC
Calculator	Evaporative Cooler Outlet Temperature
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/evaporative-cooler-outlet

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.