Wet-Bulb Temperature from Dry Bulb and Relative Humidity

Thermodynamic wet-bulb temperature, dew point, humidity ratio and enthalpy of moist air from dry-bulb temperature, relative humidity and pressure.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Dry-bulb temperature	35.000	°C
Relative humidity	40.000	%
Barometric pressure	101.33	kPa

Calculated results

Parameter	Value	Unit
Wet-bulb temperature	23.934	°C
Wet-bulb depression	11.066	K
Dew point	19.384	°C
Humidity ratio	14.133	g/kg
Enthalpy (per kg dry air)	71.478	kJ/kg

Notes for this case

• Thermodynamic (adiabatic saturation) wet bulb by ASHRAE eq. (33); a well-ventilated psychrometer reads close to it. Saturation pressure from IAPWS-IF97.

Formula and method

$$W = \frac{(2501 - 2.326 t_{wb}) W_s^* - 1.006 (t - t_{wb})}{2501 + 1.86 t - 4.186 t_{wb}}, \quad W = 0.622 \frac{\varphi p_s}{p - \varphi p_s}$$

Variables

t	Dry-bulb temperature	K
φ	Relative humidity	-
p	Barometric pressure	Pa
t_{wb}	Wet-bulb temperature	K
$t - t_{wb}$	Wet-bulb depression	K
t_{dp}	Dew point	K
W	Humidity ratio	kg/kg
h	Enthalpy (per kg dry air)	J/kg

Method and standards

ASHRAE eq. (33), solved for t_wb.

Assumptions and limits

- 0–100 °C; wet bulb above 0 °C.

References

• ASHRAE Handbook—Fundamentals (2017)
• ch. 1
• eq. (33) for the thermodynamic wet bulb; IAPWS-IF97 saturation pressure

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/wet-bulb-from-rh

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.