Dew Point Calculator (from Temperature and RH)

Dew-point temperature of air from dry-bulb temperature and relative humidity, with the vapour pressure, humidity ratio and the margin to condensation on a cold surface.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Air temperature (dry bulb)	30.000	°C
Relative humidity	70.000	%
Barometric pressure (absolute)	101.33	kPa
Surface temperature to check A chilled-water pipe, duct or wall. Condensation forms when the surface is at or below the dew point.	15.000	°C

Calculated results

Parameter	Value	Unit
Dew-point temperature	23.928	°C
Dew-point depression (air minus dew point)	6.0724	K
Surface minus dew point (negative = condensation)	-8.9276	K
Partial pressure of water vapour	2.9727	kPa
Humidity ratio	18.798	g/kg

Notes for this case

- The surface is at or below the dew point: water will condense on it. Insulate with a vapour barrier or raise the surface temperature.

Formula and method

$$p_v = \varphi\, p_{sat}(T) \qquad T_{dp} = T_{sat}(p_v) \qquad W = \frac{M_w}{M_{da}} \frac{p_v}{p - p_v}$$

Variables

T	air temperature	K
φ	relative humidity	–
p	barometric pressure	Pa
T_s	surface temperature to check	K
T_{dp}	dew point	K
$T - T_{dp}$	dew-point depression	K
$T_s - T_{dp}$	surface margin (negative = condensation)	K
p_v	vapour pressure	Pa
W	humidity ratio	kg/kg
p_{sat}, T_{sat}	IF97 saturation pressure and temperature	Pa, K

Method and standards

The vapour pressure is the relative humidity times the IAPWS-IF97 saturation pressure; the dew point is the IF97 saturation temperature at that vapour pressure.

Assumptions and limits

- Over liquid water, 0–100 °C; dew points below 0 °C (frost points) are not covered.

References

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

Report details

Report reference	FCC-SSAB-EEM2 (the same inputs always give the same reference)
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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/dew-point-from-humidity

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.