Surface Condensation Check: Inside Surface Temperature vs Dew Point

Inside surface temperature of a wall, roof or window from its U-value and the surface resistance, compared with the room dew point to check for condensation.

Method: Steady one-dimensional conduction T_si = T_i − U R_si (T_i − T_o); dew point over water or ice from IAPWS

Input parameters

Unit system: SI

Parameter	Value	Unit
Room temperature	20.000	°C
Room relative humidity	60.000	%
Outside temperature	-5.0000	°C
U-value of the element	2.8000	W/(m²·K)
Inside surface resistance Your standard's value; 0.13 m²K/W is common for walls with horizontal heat flow, higher for corners and behind furniture.	0.13000	m²·K/W

Calculated results

Parameter	Value	Unit
Inside surface temperature	10.900	°C
Room dew point	12.008	°C
Surface above dew point (negative: condensation)	-1.1076	K
Highest room RH without condensation	55.756	%

Formula and method

$$T_{si} = T_i - UR_{si}(T_i - T_o)$$

Variables

T_i	Room temperature	K
φ_i	Room relative humidity	-
T_o	Outside temperature	K
U	U-value of the element	W/(m²·K)
R_{si}	Inside surface resistance	m²·K/W
T_{si}	Inside surface temperature	K
T_{dp}	Room dew point	K
ΔT	Surface above dew point (negative: condensation)	K
φ_{max}	Highest room RH without condensation	-

Method and standards

Series resistances.

Assumptions and limits

- Steady state.
- The dew point depends only on the room's vapour pressure, so barometric pressure does not enter the check.

References

- Steady one-dimensional conduction T_si = T_i − U R_si (T_i − T_o); dew point over water or ice from IAPWS

Report details

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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/loads/surface-condensation-check

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.