Trace Moisture: ppmv to Dew or Frost Point

Dew point (over water) or frost point (over ice) of a gas from its moisture content in ppmv at line pressure, with water mass per normal volume and ppm by mass.

Method: IAPWS sublimation and IF97 saturation pressure

Input parameters

Unit system: SI

Parameter	Value	Unit
Moisture content	100.00	ppm
Line pressure (absolute)	1.0132	bar
Dry gas molar mass	28.000	kg/kmol

Calculated results

Parameter	Value	Unit
Water vapour partial pressure	10.133	Pa
Dew or frost point	-42.075	°C
Water per normal cubic metre	80.374	mg/Nm³
Moisture by mass	64.342	ppm

Notes for this case

• p_w = y·p; the dew point is where p_w equals the saturation pressure, over ice below 0.01 °C (IAPWS sublimation equation) and over water above (IAPWS-IF97). Below 0 °C supercooled water can form a dew point a few kelvin below the frost point; analysers state which they report. No enhancement factor is applied, which matters at high pressure.

Formula and method

$$p_w = y_w p, \quad p_{sat}(T_d) = p_w, \quad w = \frac{y_w M_w}{y_w M_w + (1 - y_w) M_g}$$

Variables

y_w	Moisture content	-
p	Line pressure (absolute)	Pa
M_g	Dry gas molar mass	kg/kmol
p_w	Water vapour partial pressure	Pa
T_d	Dew or frost point	K
c_w	Water per normal cubic metre	kg/m³
w	Moisture by mass	-

Method and standards

Trace moisture.

Assumptions and limits

- Ideal gas mixture; no enhancement factor.

References

IAPWS sublimation and IF97 saturation pressure

Report details

Report reference	FCC-XCWP-92QN (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/instrumentation/analysers/trace-moisture-dew-point

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.