Flue Gas Water Dew Point

Temperature at which water vapour in flue gas starts to condense, from the moisture content or from the fuel analysis and excess air.

Method: IAPWS R7-97(2012) IF97 (saturation); ASME PTC 4-2013 (air composition)

Input parameters

Unit system: SI

Parameter	Value	Unit
Water vapour content from	Fuel analysis and excess air	
Water vapour in wet flue gas, by volume	10.000	%
Carbon	45.000	%
Hydrogen	3.5000	%
Oxygen	5.0000	%
Nitrogen	1.0000	%
Sulphur	0.50000	%
Ash	35.000	%
Moisture	10.000	%
Excess air	20.000	%
Air humidity (kg water per kg dry air)	0.013000	kg/kg
Flue gas pressure (absolute) Absolute; atmospheric for most ducts and stacks.	1.0132	bar

Calculated results

Parameter	Value	Unit
Water dew point	46.409	°C
Partial pressure of water vapour	0.10312	bar
Water vapour in wet flue gas used	10.177	%

Formula and method

$$p_{H_2O} = y_{H_2O}\, p \qquad T_{dp} = T_{sat}\left(p_{H_2O}\right)$$

Variables

basis	water vapour content entered, or from the fuel	–
y_{H_2O}	water vapour in wet flue gas by volume, entered	–
$C\$, \$H\$, \$O\$, \$N\$, \$S$	carbon, hydrogen, oxygen, nitrogen, sulphur in the fuel as fired	–
A	ash	–
M	moisture	–
EA	excess air	–
ω	air humidity, kg water per kg dry air	kg/kg
p	flue gas absolute pressure	Pa
T_{dp}	water dew point	K
p_{H_2O}	partial pressure of water vapour	Pa
y	water vapour fraction used	–

Method and standards

Dalton's law of partial pressures for an ideal-gas mixture, and the saturation temperature at the partial pressure from the IAPWS-IF97 region 4 equation (FireCAD's own implementation). The water content from the fuel uses the exact-ratio combustion balance with ASME PTC 4-2013 air.

Assumptions and limits

- Ideal-gas mixture; the enhancement factor (below 0.5 % at atmospheric pressure) is neglected; above about 5 bar a warning appears.
- A partial pressure below the triple point (dew point below 0 °C) is rejected; the frost point applies there.
- Pure water: dissolved acids raise the actual condensation temperature (see the acid dew point).
- Complete combustion; no water from atomising steam or soot blowing unless included in the content entered.

References

• IAPWS R7-97(2012) IF97 (saturation)
• ASME PTC 4-2013 (air composition)

Report details

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Software release	FireCAD Calc, release of 17 November 2026
Release checks	4 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/boilers-power-plant/combustion/flue-gas-water-dew-point

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.