Gas Distribution between Steam and Water (CO_2, O_2, H_2S and others)

Concentration of a dissolved gas in steam from its concentration in boiler or condensate water at a temperature (IAPWS G7-04 distribution constant).

Method: IAPWS G7-04; Guideline on the Henry's Constant and Vapor-Liquid Distribution Constant for Gases in H_2O and D_2O at High Temperatures (2004)

Input parameters

Unit system: SI

Parameter	Value	Unit
Gas	Carbon dioxide CO_2	
Saturation temperature	180.00	°C
Gas in the water (by mass)	50.000	ppb

Calculated results

Parameter	Value	Unit
Distribution constant y/x	584.02	
Gas in the steam (by mass)	29,201	ppb
Saturation pressure	10.026	bar

Notes for this case

- Mass ratio equals the mole ratio for dilute gases in water (same solvent on both sides).
- Enter the molecular (un-ionised) gas only: K_D does not apply to bicarbonate, carbonate or HS^-.

Formula and method

$$K_D = \frac{y}{x}, \quad w_s = K_D w_w$$

Variables

gas	Gas	-
T	Saturation temperature	K
w_w	Gas in the water (by mass)	-
K_D	Distribution constant y/x	-
w_s	Gas in the steam (by mass)	-
p_{sat}	Saturation pressure	Pa

Method and standards

IAPWS G7-04.

Assumptions and limits

- Equilibrium, dilute.
- For CO_2 and H_2S the water figure is the molecular gas only, not total CO_2 or sulphide: bicarbonate, carbonate and HS^- do not distribute to steam by K_D.
- A result above 100 % gas in the steam is rejected; above 1 % the dilute-solution assumption no longer holds and a warning is given.

References

- IAPWS G7-04
- Guideline on the Henry's Constant and Vapor-Liquid Distribution Constant for Gases in H_2O and D_2O at High Temperatures (2004)

Report details

Report reference	FCC-PKH1-C46X (the same inputs always give the same reference)
Generated	17 November 2026, 19:50 UTC
Calculator	Gas Distribution between Steam and Water (CO_2, O_2, H_2S and others)
Method last reviewed	13 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/boilers-power-plant/water-treatment/gas-distribution-steam-water

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.