Deaerator Oxygen: Steam–Water Equilibrium

Equilibrium oxygen in deaerated water for the steam-phase oxygen at deaerator pressure, and the steam-phase limit for a target (IAPWS G7-04 K_D).

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); T_sat from IAPWS-IF97

Input parameters

Unit system: SI

Parameter	Value	Unit
Deaerator pressure (absolute)	1.3000	bar
Oxygen in the steam phase (by volume)	2.0000	ppm
Target oxygen in the water (by mass)	7.0000	ppb

Calculated results

Parameter	Value	Unit
Saturation temperature	107.11	°C
Distribution constant y/x	52,412	
Equilibrium oxygen in the water (by mass)	0.067778	ppb
Steam-phase oxygen for the target	206.56	ppm

Notes for this case

- Equilibrium is the best case: real deaerators approach it only with enough venting, contact time and full heating to saturation.

Formula and method

$$x = \frac{y}{K_D(T_{sat})}, \quad w = x\frac{M_{O_2}}{M_{H_2O}}, \quad y_{max} = K_D\, w_t \frac{M_{H_2O}}{M_{O_2}}$$

Variables

p	Deaerator pressure (absolute)	Pa
y	Oxygen in the steam phase (by volume)	-
w_t	Target oxygen in the water (by mass)	-
T_{sat}	Saturation temperature	K
K_D	Distribution constant y/x	-
w	Equilibrium oxygen in the water (by mass)	-
y_{max}	Steam-phase oxygen for the target	-
x	Oxygen mole fraction in the water	-
M_{O_2}	Molar mass of oxygen	kg/kmol
M_{H_2O}	Molar mass of water	kg/kmol

Method and standards

IAPWS G7-04.

Assumptions and limits

- Equilibrium at saturation.
- If the target would allow a steam phase of more than pure oxygen, y_max is not shown and a note says the target sets no limit.

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); T_sat from IAPWS-IF97

Report details

Report reference	FCC-WDTY-5TMW (the same inputs always give the same reference)
Generated	17 November 2026, 19:50 UTC
Calculator	Deaerator Oxygen: Steam–Water Equilibrium
Method last reviewed	13 November 2026
Software release	FireCAD Calc, release of 17 November 2026
Release checks	2 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/deaerator-oxygen-equilibrium

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.