Diffused Air for Post-aeration of Effluent (Plug Flow)

Air flow to raise effluent dissolved oxygen in a plug-flow post-aeration channel, from saturation, transfer efficiency and temperature (log-mean driving force).

Input parameters

Unit system: SI

Parameter	Value	Unit
Effluent flow	3,800.0	m³/d
Saturation DO at 20 °C	9.0900	mg/L
DO entering	1.5000	mg/L
DO required leaving	5.0000	mg/L
Oxygen transfer efficiency	6.0000	%
Water temperature	25.000	°C
Air density	1.2300	kg/m³
Oxygen mass fraction of air	23.000	%
Safety factor for wastewater saturation and transfer (about 1.1)	1.1000	

Calculated results

Parameter	Value	Unit
Air flow	0.85366	m³/min
Oxygen dissolved	13.300	kg/d
Air-to-water ratio	0.32349	m³/m³

Notes for this case

• The logarithm comes from integrating the transfer rate along the channel, where the oxygen deficit falls from C_s − C_i to C_s − C_o. Designers suggest multiplying by about 1.1 because wastewater saturates at about 95 % of clean water and transfers less readily.

Formula and method

$$Q_a = \frac{f}{\rho_a w_{O_2}} \frac{Q\,C_{s,20}}{E(1.024)^{T-20}} \ln \frac{C_s - C_i}{C_s - C_o}$$

Variables

Q	Effluent flow	m³/s
C_s	Saturation DO at 20 °C	kg/m³
C_i	DO entering	kg/m³
C_o	DO required leaving	kg/m³
E	Oxygen transfer efficiency	-
T	Water temperature	K
ρ_a	Air density	kg/m³
w_{O_2}	Oxygen mass fraction of air	-
f	Safety factor for wastewater saturation and transfer (about 1.1)	-
Q_a	Air flow	m³/s
$\dot{m}_{O_2}$	Oxygen dissolved	kg/s
Q_a/Q	Air-to-water ratio	m³/m³

Method and standards

Plug-flow oxygen transfer with a log-mean deficit.

Assumptions and limits

- Plug flow; E at the diffuser depth; T in °C.

Report details

Report reference	FCC-RK9P-T00C (the same inputs always give the same reference)
Generated	23 November 2026, 17:50 UTC
Calculator	Diffused Air for Post-aeration of Effluent (Plug Flow)
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 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/environmental/wastewater/diffused-air-postaeration

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.