Settling Tank: Stokes Velocity and Overflow Rate

Settling velocity of a particle by Stokes' law and the surface (overflow) rate of a settling tank, with the area needed to remove that particle size.

Method: Stokes' law v = g(ρ_p − ρ)d²/(18μ); ideal settling basin (Hazen): removal when v_s ≥ Q/A

Input parameters

Unit system: SI

Parameter	Value	Unit
Flow to the tank	50.000	m³/h
Tank surface area	40.000	m²
Particle diameter	50.000	µm
Particle density	2,650.0	kg/m³
Liquid density	998.00	kg/m³
Liquid viscosity	0.001000	Pa·s

Calculated results

Parameter	Value	Unit
Stokes settling velocity	8.1003	m/h
Particle Reynolds number	0.11228	
Overflow rate Q/A	1.2500	m/h
Area to settle this particle	6.1726	m²

Formula and method

$$v_s = \frac{g(\rho_p - \rho_l)d^2}{18\mu}, \quad v_o = \frac{\dot{V}}{A}, \quad A_n = \frac{\dot{V}}{v_s}$$

Variables

$\dot{V}$	Flow to the tank	m³/s
A	Tank surface area	m²
d	Particle diameter	m
ρ_p	Particle density	kg/m³
ρ_l	Liquid density	kg/m³
μ	Liquid viscosity	Pa·s
v_s	Stokes settling velocity	m/s
Re_p	Particle Reynolds number	-
v_o	Overflow rate Q/A	m/s
A_n	Area to settle this particle	m²

Method and standards

Stokes and Hazen.

Assumptions and limits

- Spherical, discrete particles.

References

- Stokes' law v = g(ρ_p − ρ)d²/(18μ); ideal settling basin (Hazen): removal when v_s ≥ Q/A

Report details

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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/chemical/separation/settling-tank-stokes

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.