Dispersion Number of an Open-Channel or Contact Basin

Velocity, hydraulic radius, Reynolds number, longitudinal dispersion coefficient and dispersion number of flow through an open channel or serpentine contactor.

Input parameters

Unit system: SI

Parameter	Value	Unit
Flow	20,000	m^3/d
Channel width	2.0000	m
Water depth	4.0000	m
Channel length (flow path)	300.00	m
Kinematic viscosity	1.3100e-06	m^2/s

Calculated results

Parameter	Value	Unit
Mean velocity	0.028935	m/s
Hydraulic radius	0.80000	m
Reynolds number (4vR_h/v)	70,681	
Longitudinal dispersion coefficient	0.023160	m^2/s
Dispersion number E/(vL)	0.002668	
Mean hydraulic residence time	172.80	min

Notes for this case

- Empirical dispersion coefficient for turbulent open-channel flow. Dispersion numbers below about 0.025 approach plug flow; baffling a contact tank lengthens the path and lowers d.

Formula and method

$$Re = \frac{4vR_h}{\nu}, \quad E = 1.01\nu Re^{0.875}, \quad d = \frac{E}{vL}$$

Variables

Q	Flow	m^3/s
W	Channel width	m
h	Water depth	m
L	Channel length (flow path)	m
ν	Kinematic viscosity	m^2/s
v	Mean velocity	m/s
R_h	Hydraulic radius	m
Re	Reynolds number (4vR_h/v)	-
E	Longitudinal dispersion coefficient	m^2/s
d	Dispersion number E/(vL)	-
τ	Mean hydraulic residence time	s

Method and standards

Empirical longitudinal dispersion in open channels.

Assumptions and limits

- Turbulent, uniform channel flow.

Report details

Report reference	FCC-QJ81-AM5X (the same inputs always give the same reference)
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Calculator	Dispersion Number of an Open-Channel or Contact Basin
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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/drinking-water/open-channel-dispersion-number

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.