Disinfection Contact Time with Temperature Correction (Chick-Watson)

Contact time for a log kill at a disinfectant residual from the coefficient of specific lethality, corrected from one temperature to another by van't Hoff-Arrhenius.

Input parameters

Unit system: SI

Parameter	Value	Unit
Coefficient of specific lethality at T_1 (L/mg·min, base 10)	10.500	
Coefficient of dilution	1.0000	
Disinfectant residual	0.050000	mg/L
Log inactivation required	3.0000	
Temperature of the known coefficient	5.0000	°C
Design temperature	25.000	°C
Activation energy	26.800	kJ/mol

Calculated results

Parameter	Value	Unit
Coefficient at the design temperature	22.845	
Contact time at T_1	5.7143	min
Contact time at T_2	2.6264	min
CT at T_2 (mg·min/L)	0.13132	

Notes for this case

• Chick-Watson in base-10 form: log(N/N₀) = −Λ Cⁿ t. The activation energy depends on the disinfectant and pH; warmer water disinfects faster.

Formula and method

$$\log\frac{N}{N_o} = -\Lambda C^n t, \quad \ln\frac{\Lambda_2}{\Lambda_1} = \frac{E(T_2 - T_1)}{R T_1 T_2}$$

Variables

Λ_1	Coefficient of specific lethality at T_1 (L/mg·min, base 10)	-
n	Coefficient of dilution	-
C	Disinfectant residual	kg/m³
$\log(N_o/N)$	Log inactivation required	-
T_1	Temperature of the known coefficient	K
T_2	Design temperature	K
E	Activation energy	J/mol
Λ_2	Coefficient at the design temperature	-
t_1	Contact time at T_1	s
t_2	Contact time at T_2	s
CT_2	CT at T_2 (mg·min/L)	-

Method and standards

Chick-Watson with van't Hoff-Arrhenius temperature correction.

Assumptions and limits

- Constant residual over the contact time.

Report details

Report reference	FCC-DYPH-5DTK (the same inputs always give the same reference)
Generated	23 November 2026, 17:50 UTC
Calculator	Disinfection Contact Time with Temperature Correction (Chick-Watson)
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/disinfection-temperature-correction

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.