Optimum Heat Exchanger Cleaning Interval

Cleaning interval that minimises the average cost of fouling plus cleaning when the fouling penalty grows linearly, with cleanings per year.

Method: Minimum average cost per unit time with a linearly rising fouling penalty (engineering economics; definitions)

Input parameters

Unit system: SI

Parameter	Value	Unit
Cost per cleaning (currency)	150,000	
Downtime per cleaning	2.0000	d
Fouling penalty rate at the reference time (currency per day)	4,000.0	
Reference time after cleaning	90.000	d

Calculated results

Parameter	Value	Unit
Growth of the penalty (currency per day²)	44.444	
Optimum run time between cleanings	80.183	d
Average cost at the optimum (currency per day)	3,563.7	
Cleanings per year	4.4413	

Notes for this case

• Linear growth of the penalty suits steadily fouling services; for asymptotic fouling the optimum is longer. Include lost production in the cost per cleaning if the plant must slow down.

Formula and method

$$\bar{C}(t) = \frac{C_c + a t^2/2}{t + t_d}, \quad t^* = -t_d + \sqrt{t_d^2 + \frac{2C_c}{a}}, \quad a = \frac{L_r}{t_r}$$

Variables

C_c	Cost per cleaning (currency)	-
t_d	Downtime per cleaning	s
L_r	Fouling penalty rate at the reference time (currency per day)	-
t_r	Reference time after cleaning	s
a	Growth of the penalty (currency per day²)	-
t^*	Optimum run time between cleanings	s
$\bar{C}$	Average cost at the optimum (currency per day)	-
n	Cleanings per year	-

Method and standards

Cost-rate minimisation.

Assumptions and limits

- Linear fouling penalty; same cost each cleaning.

References

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Report details

Report reference	FCC-H1BP-17WH (the same inputs always give the same reference)
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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/process-heat-exchangers/exchanger-cleaning-interval

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.