Measured U and Cleanliness Factor from Plant Data

Overall coefficient from measured duty, area and LMTD, the cleanliness factor against the clean design value and the implied fouling resistance.

Method: U = Q/(A ΔT_lm); CF = U/U_clean; R_f = 1/U − 1/U_clean

Input parameters

Unit system: SI

Parameter	Value	Unit
Measured duty	5,000.0	kW
Heat-transfer area	400.00	m²
Mean temperature difference (LMTD × F for multipass exchangers)	25.000	K
Design (clean) coefficient	650.00	W/(m²·K)

Calculated results

Parameter	Value	Unit
Measured coefficient	500.00	W/(m²·K)
Cleanliness factor U/U_c	76.923	%
Implied fouling resistance	4.6154e-04	m²·K/W

Notes for this case

- Compare at similar flows: U changes with velocity as well as fouling. Trend the cleanliness factor to time cleaning.

Formula and method

$$U = \frac{\dot{Q}}{A \Delta T_{lm}}, \quad CF = \frac{U}{U_c}, \quad R_f = \frac{1}{U} - \frac{1}{U_c}$$

Variables

$\dot{Q}$	Measured duty	W
A	Heat-transfer area	m²
ΔT_{lm}	Mean temperature difference (LMTD × F for multipass exchangers)	K
U_c	Design (clean) coefficient	W/(m²·K)
U	Measured coefficient	W/(m²·K)
CF	Cleanliness factor U/U_c	-
R_f	Implied fouling resistance	m²·K/W

Method and standards

Definitions.

Assumptions and limits

- Steady state.
- For multipass or cross-flow exchangers enter F × LMTD: with the plain LMTD the measured U comes out low by the factor F.

References

- U = Q/(A ΔT_lm); CF = U/U_clean; R_f = 1/U − 1/U_clean

Report details

Report reference	FCC-CFDG-2NF3 (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/mechanical/heat-transfer/heat-transfer-cleanliness-factor

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.