Dust Collectors in Series: Overall Efficiency and Outlet Load

Overall collection efficiency of up to three dust collectors in series, the outlet concentration and the dust captured from the inlet concentration and gas flow.

Method: Penetrations multiply: 1 − η_o = Π(1 − η_i)

Input parameters

Unit system: SI

Parameter	Value	Unit
Collector 1 efficiency	85.000	%
Collector 2 efficiency	99.500	%
Collector 3 efficiency (0 if none)	0	%
Inlet dust concentration	40,000	mg/Nm³
Gas flow (normal)	150,000	Nm³/h

Calculated results

Parameter	Value	Unit
Overall efficiency	99.925	%
Outlet concentration	30.000	mg/Nm³
Dust captured	5.9955	t/h

Notes for this case

- Each stage's efficiency is for the dust that reaches it; a fine-dust stage after a cyclone sees a finer, harder dust.

Formula and method

$$\eta_o = 1 - \prod_i (1 - \eta_i), \quad C_{out} = C_{in} \prod_i (1 - \eta_i)$$

Variables

η_1	Collector 1 efficiency	-
η_2	Collector 2 efficiency	-
η_3	Collector 3 efficiency (0 if none)	-
C_{in}	Inlet dust concentration	kg/m³
$\dot{V}_N$	Gas flow (normal)	Nm³/s
η_o	Overall efficiency	-
C_{out}	Outlet concentration	kg/m³
$\dot{m}_c$	Dust captured	kg/s

Method and standards

Penetration.

Assumptions and limits

- Independent stages: each η_i is the efficiency for the dust that actually reaches that stage. A collector after a cyclone sees finer dust, so its catalogue efficiency (quoted for the raw dust) overstates the overall result.

References

- Penetrations multiply: 1 − η_o = Π(1 − η_i)

Report details

Report reference	FCC-W90X-8YKW (the same inputs always give the same reference)
Generated	17 November 2026, 19:35 UTC
Calculator	Dust Collectors in Series: Overall Efficiency and Outlet Load
Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/environmental/air-pollution/collection-efficiency-series

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.