Dryer Thermal Efficiency and Specific Heat Use

Thermal efficiency of a convective dryer from water evaporated, latent heat and heat supplied, with the ideal adiabatic efficiency (T_in − T_out)/(T_in − T_ambient).

Input parameters

Unit system: SI

Parameter	Value	Unit
Water evaporated	2,000.0	kg/h
Latent heat of evaporation	2,330.0	kJ/kg
Heat supplied to the dryer	2,200.0	kW
Inlet air temperature	180.00	°C
Exhaust air temperature	80.000	°C
Ambient temperature	25.000	°C

Calculated results

Parameter	Value	Unit
Thermal efficiency	58.838	%
Heat per kg of water evaporated	3.9600	MJ/kg
Adiabatic (ideal) efficiency	64.516	%

Notes for this case

- Raising the inlet temperature or lowering the exhaust temperature (within dew-point and product limits) improves efficiency most.

Formula and method

$$\eta = \frac{E\lambda}{Q}, \quad \eta_{ad} = \frac{T_1 - T_2}{T_1 - T_0}$$

Variables

E	Water evaporated	kg/s
λ	Latent heat of evaporation	J/kg
Q	Heat supplied to the dryer	W
T_1	Inlet air temperature	K
T_2	Exhaust air temperature	K
T_0	Ambient temperature	K
η	Thermal efficiency	-
Q/E	Heat per kg of water evaporated	J/kg
η_{ad}	Adiabatic (ideal) efficiency	-

Method and standards

Energy balance definitions.

Assumptions and limits

- Steady operation.
- Notes flag the impossible cases: latent heat above the heat supplied, or exhaust colder than ambient.

Report details

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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/drying/dryer-thermal-efficiency

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.