Flat-Plate Collector Mean Fluid and Plate Temperatures

Mean fluid and mean absorber plate temperatures of a flat-plate collector from inlet temperature, useful gain, heat removal and flow factors and loss coefficient.

Input parameters

Unit system: SI

Parameter	Value	Unit
Fluid inlet temperature	60.000	°C
Useful gain per unit collector area	500.00	W/m²
Heat removal factor	85.000	%
Collector flow factor	96.000	%
Overall loss coefficient	4.0000	W/(m²·K)

Calculated results

Parameter	Value	Unit
Mean fluid temperature	65.882	°C
Mean plate temperature	82.059	°C

Notes for this case

- The mean plate temperature sets the losses, so U_L should be evaluated at T_pm; with a temperature-dependent U_L iterate.

Formula and method

$$T_{fm} = T_i + \frac{Q_u/A_c}{F_R U_L}(1 - F''), \quad T_{pm} = T_i + \frac{Q_u/A_c}{F_R U_L}(1 - F_R)$$

Variables

T_i	Fluid inlet temperature	K
q_u	Useful gain per unit collector area	W/m²
F_R	Heat removal factor	-
F''	Collector flow factor	-
U_L	Overall loss coefficient	W/(m²·K)
T_{fm}	Mean fluid temperature	K
T_{pm}	Mean plate temperature	K

Method and standards

Hottel–Whillier–Bliss mean temperature relations.

Assumptions and limits

- Steady state; constant U_L.

Report details

Report reference	FCC-EYYX-A5G5 (the same inputs always give the same reference)
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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/solar-thermal/collector-mean-fluid-plate-temperature

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.