Cooling Tower Range, Approach and Effectiveness

Range, approach, effectiveness, liquid-to-gas ratio and heat rejected by a wet cooling tower from hot and cold water temperatures, wet bulb and flows.

Method: IAPWS R7-97(2012) IF97; CTI and BEE cooling tower performance terms

Input parameters

Unit system: SI

Parameter	Value	Unit
Hot water temperature (to tower)	41.000	°C
Cold water temperature (from basin)	32.000	°C
Ambient wet-bulb temperature	27.000	°C
Water flow	1.0800e+07	kg/h
Dry air flow	9,720,000	kg/h
Atmospheric pressure	1.0132	bar

Calculated results

Parameter	Value	Unit
Range	9.0000	K
Approach to wet bulb	5.0000	K
Effectiveness R/(R + A)	64.286	%
Liquid-to-gas ratio	1.1111	kg/kg
Heat rejected	112.83	MW

Formula and method

$$R = T_{hot} - T_{cold} \qquad A = T_{cold} - T_{wb} \qquad \varepsilon = \frac{R}{R + A} \qquad \frac{L}{G} \qquad \dot{Q} = L\,[h(T_{hot}) - h(T_{cold})]$$

Variables

T_{hot}	hot water temperature	K
T_{cold}	cold water temperature	K
T_{wb}	ambient wet-bulb temperature	K
L	water flow	kg/s
G	dry air flow	kg/s
p	atmospheric pressure	Pa
R	range	K
A	approach	K
$\mathcal{E}$	effectiveness	–
L/G	liquid-to-gas ratio	kg/kg
$\dot{Q}$	heat rejected	W
h	water enthalpy	J/kg

Method and standards

Range, approach and effectiveness as defined in cooling-tower practice (CTI terms; the BEE energy audit guide calls effectiveness "efficiency"); heat from water enthalpy by FireCAD's IAPWS-IF97.

Assumptions and limits

- Steady load; water loss by evaporation neglected in the heat balance.
- The air flow is used only for L/G; there is no air-side heat balance, so an L/G the air cannot support is not detected. Use the

Merkel calculator to check the tower can do the duty.

References

• IAPWS R7-97(2012) IF97
• CTI and BEE cooling tower performance terms

Report details

Report reference	FCC-SSRH-0FV5 (the same inputs always give the same reference)
Generated	17 November 2026, 19:46 UTC
Calculator	Cooling Tower Range, Approach and Effectiveness
Method last reviewed	11 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/boilers-power-plant/condensers-cooling/cooling-tower-performance

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.