Absorption Chiller: Steam or Heat Input for a Cooling Load

Heat input and steam consumption of a single- or double-effect absorption chiller from the cooling capacity, its COP and the steam pressure (IF97).

Method: Energy balance Q_g = Q_e/COP; steam and condensate enthalpies from IAPWS-IF97

Input parameters

Unit system: SI

Parameter	Value	Unit
Cooling capacity	300.00	TR
Thermal COP About 0.7 for single-effect, 1.2–1.4 for double-effect; from the maker.	1.3000	
Steam pressure (absolute)	9.0000	bar
Condensate leaving temperature	90.000	°C

Calculated results

Parameter	Value	Unit
Heat input to the generator	811.58	kW
Heat given up per kg of steam	2,395.4	kJ/kg
Steam consumption	1,219.7	kg/h
Steam per TR	4.0657	kg/h
Heat rejected to the cooling tower	1,866.6	kW

Notes for this case

- Dry saturated steam assumed; wet steam gives less heat per kg. A tower for an absorption chiller rejects much more heat than for an electric chiller.

Formula and method

$$\dot{Q}_g = \frac{\dot{Q}_e}{COP}, \quad \dot{m}_s = \frac{\dot{Q}_g}{h_g(p_s) - h(p_s, T_c)}, \quad \dot{Q}_r = \dot{Q}_e + \dot{Q}_g$$

Variables

$\dot{Q}_e$	Cooling capacity	W
COP	Thermal COP	-
p_s	Steam pressure (absolute)	Pa
T_c	Condensate leaving temperature	K
$\dot{Q}_g$	Heat input to the generator	W
Δh	Heat given up per kg of steam	J/kg
$\dot{m}_s$	Steam consumption	kg/s
$\dot{m}_s/TR$	Steam per TR	kg/s
$\dot{Q}_r$	Heat rejected to the cooling tower	W

Method and standards

Energy balance.

Assumptions and limits

- Dry saturated steam at p_s; superheated or wet supply steam is not an input (wet steam gives less heat per kg).
- The heat rejected is cooling plus heat input; the solution pump power, which also ends up in the tower, is left out.

References

- Energy balance Q_g = Q_e/COP; steam and condensate enthalpies from IAPWS-IF97

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/hvac/chillers/absorption-chiller-steam

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.