Carnot Efficiency of a Heat Engine

Carnot (maximum possible) efficiency of a heat engine between source and sink temperatures, the actual engine's share of it and the heat rejected.

Method: Carnot (1824): η = 1 − T_C/T_H

Input parameters

Unit system: SI

Parameter	Value	Unit
Heat source temperature	540.00	°C
Heat sink temperature	45.000	°C
Actual engine efficiency	38.000	%
Heat supplied	100.00	MW

Calculated results

Parameter	Value	Unit
Carnot efficiency 1 − T_C/T_H	60.874	%
Second-law (relative) efficiency	62.424	%
Actual work output	38.000	MW
Heat rejected	62.000	MW

Notes for this case

- Absolute temperatures only.

Formula and method

$$\eta_C = 1 - \frac{T_C}{T_H}, \quad \frac{\eta}{\eta_C}, \quad W = \eta \dot{Q}_H, \quad \dot{Q}_C = (1 - \eta)\,\dot{Q}_H$$

Variables

T_H	Heat source temperature	K
T_C	Heat sink temperature	K
η	Actual engine efficiency	-
$\dot{Q}_H$	Heat supplied	W
η_C	Carnot efficiency 1 − T_C/T_H	-
η/η_C	Second-law (relative) efficiency	-
W	Actual work output	W
$\dot{Q}_C$	Heat rejected	W

Method and standards

Second law of thermodynamics: no engine between two temperatures can beat the reversible (Carnot) engine; the ratio of the actual to the Carnot efficiency is the second-law efficiency, and the heat not turned into work is rejected to the sink.

Assumptions and limits

- Reversible engine for the Carnot figure; an actual efficiency above it is rejected.

References

- Carnot (1824): η = 1 − T_C/T_H

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/boilers-power-plant/turbines-cycles/carnot-efficiency

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.