Propeller Thrust, Power and Torque Coefficients and Efficiency

Advance ratio, thrust, power and torque coefficients, propulsive efficiency and tip Mach number of a propeller from measured thrust, power, speed and diameter.

Method: Propeller non-dimensional coefficients

Input parameters

Unit system: SI

Parameter	Value	Unit
Thrust	1,800.0	N
Shaft power	85.000	kW
Rotational speed	2,400.0	rpm
Diameter	1.9000	m
Flight (advance) speed	50.000	m/s
Fluid density	1.1120	kg/m³
Speed of sound (air; about 1,500 in water)	336.40	m/s

Calculated results

Parameter	Value	Unit
Advance ratio V/(nD)	0.65789	
Thrust coefficient T/(ρn²D⁴)	0.077631	
Power coefficient P/(ρn³D⁵)	0.048235	
Torque coefficient C_P/(2π)	0.007677	
Propulsive efficiency J C_T/C_P	105.88	%
Helical tip Mach number	0.72515	

Notes for this case

- Coefficients in revolutions per second (n) and diameter; η = TV/P. Marine practice uses K_T = C_T and K_Q = C_Q with η_o = J K_T/(2π K_Q).

Formula and method

$$J = \frac{V}{nD}, \quad C_T = \frac{T}{\rho n^2 D^4}, \quad C_P = \frac{P}{\rho n^3 D^5}, \quad \eta = J\frac{C_T}{C_P}$$

$$M_{tip} = \frac{\sqrt{(\pi n D)^2 + V^2}}{a}$$

Variables

T	Thrust	N
P	Shaft power	W
n	Rotational speed	1/s
D	Diameter	m
V	Flight (advance) speed	m/s
ρ	Fluid density	kg/m³
a	Speed of sound (air; about 1,500 in water)	m/s

J	Advance ratio V/(nD)	-
C_T	Thrust coefficient T/(ρn²D⁴)	-
C_P	Power coefficient P/(ρn³D⁵)	-
C_Q	Torque coefficient C_P/(2π)	-
η	Propulsive efficiency J C_T/C_P	-
M_{tip}	Helical tip Mach number	-

Method and standards

Propeller similarity coefficients.

Assumptions and limits

- Steady axial flow.

References

Propeller non-dimensional coefficients

Report details

Report reference	FCC-QWAW-CMMF (the same inputs always give the same reference)
Generated	23 November 2026, 17:50 UTC
Calculator	Propeller Thrust, Power and Torque Coefficients and Efficiency
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 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/mechanical/aerospace/propeller-performance-coefficients

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.