Airspeed Conversion: Calibrated, Equivalent, True Airspeed and Mach

True airspeed, equivalent airspeed and Mach number from calibrated airspeed at a pressure altitude and temperature deviation, with compressible pitot relations.

Method: Compressible pitot–static relations with the ISO 2533 atmosphere

Input parameters

Unit system: SI

Parameter	Value	Unit
Calibrated airspeed	250.00	kn
Pressure altitude (ISA, geopotential)	6,000.0	m
Temperature deviation from ISA	10.000	K

Calculated results

Parameter	Value	Unit
Mach number	0.54351	
True airspeed	340.95	kn
Equivalent airspeed	245.33	kn
Impact (pitot minus static) pressure	10.498	kPa
Speed of sound	322.72	m/s
Air density	0.63424	kg/m³

Notes for this case

- Subsonic compressible pitot relations (γ = 1.4) with the ISA sea-level datum for calibration; density from the pressure altitude and the actual temperature.

Formula and method

$$q_c = p_0\left[\left(1+0.2\left(\frac{V_c}{a_0}\right)^2\right)^{3.5}-1\right],\quad M=\sqrt{5\left[\left(\frac{q_c}{p}+1\right)^{2/7}-1\right]}$$

$$V = Ma,\quad V_e = V\sqrt{\rho/\rho_0}$$

Variables

V_c	Calibrated airspeed	m/s
h_p	Pressure altitude (ISA, geopotential)	m
ΔT	Temperature deviation from ISA	K
M	Mach number	-
V	True airspeed	m/s
V_e	Equivalent airspeed	m/s
q_c	Impact (pitot minus static) pressure	Pa
a	Speed of sound	m/s
ρ	Air density	kg/m³

Method and standards

Pitot–static airspeed relations.

Assumptions and limits

- Subsonic flow, no instrument or position error, γ = 1.4.

References

Compressible pitot–static relations with the ISO 2533 atmosphere

Report details

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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/mechanical/aerospace/airspeed-cas-tas-mach

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.