Aircraft Stall Speed, in Level Flight and in a Banked Turn

Stall speed of an aircraft from weight, wing area and maximum lift coefficient at altitude, as true and equivalent airspeed, and in a banked turn.

Method: Stall speed from the maximum lift coefficient; load factor in a level turn

Input parameters

Unit system: SI

Parameter	Value	Unit
Aircraft weight	12,000	N
Wing area	16.200	m²
Maximum lift coefficient (with the flap setting)	1.6000	
Altitude (ISA, geopotential)	1,500.0	m
Bank angle (0 for wings level)	30.000	°

Calculated results

Parameter	Value	Unit
Stall speed, wings level (true airspeed)	106.50	km/h
Stall speed, wings level (equivalent airspeed)	98.974	km/h
Load factor in the turn 1/cos φ	1.1547	
Stall speed in the turn (true)	114.44	km/h
Wing loading	740.74	Pa
Typical lift-off speed 1.2 V_s	127.80	km/h

Notes for this case

• V_s = √(2W/(ρSC_L,max)). The equivalent (indicated, ignoring errors) stall speed is the same at every altitude; the true stall speed rises with altitude. In a turn it rises with √n.

Formula and method

$$V_s = \sqrt{\frac{2W}{\rho S C_{L,max}}}, \quad n = \frac{1}{\cos\phi}, \quad V_{s,turn} = V_s\sqrt{n}$$

Variables

W	Aircraft weight	N
S	Wing area	m²
$C_{L,max}$	Maximum lift coefficient (with the flap setting)	-
h	Altitude (ISA, geopotential)	m
ϕ	Bank angle (0 for wings level)	rad
V_s	Stall speed, wings level (true airspeed)	m/s
$V_{s,EAS}$	Stall speed, wings level (equivalent airspeed)	m/s
n	Load factor in the turn 1/cos φ	-
$V_{s,turn}$	Stall speed in the turn (true)	m/s
W/S	Wing loading	Pa
$1.2V_s$	Typical lift-off speed 1.2 V_s	m/s

Method and standards

Stall speed from lift at C_L,max.

Assumptions and limits

- Steady flight, ISA, C_L,max for the configuration.

References

Stall speed from the maximum lift coefficient; load factor in a level turn

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/mechanical/aerospace/aircraft-stall-speed

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Reopens the calculator with the inputs of this report.