Crosswind and Headwind Components on a Runway

Crosswind and headwind (or tailwind) components of the wind on a runway from the wind and the runway heading, with a check against the aircraft's limit.

Method: Resolution of the wind into runway components

Input parameters

Unit system: SI

Parameter	Value	Unit
Wind speed	18.000	kn
Wind direction (from)	250.00	°
Runway heading	220.00	°
Maximum demonstrated crosswind	15.000	kn

Calculated results

Parameter	Value	Unit
Angle between wind and runway	30.000	°
Crosswind component	9.0000	kn
Headwind component (negative = tailwind)	15.588	kn
Crosswind relative to the limit	0.60000	

Notes for this case

- Components V_w sin α across and V_w cos α along the runway. Use the gust value for the crosswind limit.

Formula and method

$$V_{xw} = V_w \left| \sin(\theta_w - \theta_r) \right|, \quad V_{hw} = V_w \cos(\theta_w - \theta_r)$$

Variables

V_w	Wind speed	m/s
θ_w	Wind direction (from)	rad
θ_r	Runway heading	rad
$V_{xw,max}$	Maximum demonstrated crosswind	m/s
α	Angle between wind and runway	rad
V_{xw}	Crosswind component	m/s
V_{hw}	Headwind component (negative = tailwind)	m/s
$V_{xw}/V_{xw,max}$	Crosswind relative to the limit	-

Method and standards

Vector resolution of the wind.

Assumptions and limits

- Steady wind; directions in the same reference (true or magnetic).

References

Resolution of the wind into runway components

Report details

Report reference	FCC-AC0J-M8RK (the same inputs always give the same reference)
Generated	23 November 2026, 17:50 UTC
Calculator	Crosswind and Headwind Components on a Runway
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/crosswind-headwind-component

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.