Solar Panel Row Spacing to Avoid Shading

Gap and pitch between rows of tilted solar panels so that one row does not shade the next, from the tilt, latitude, date (declination) and time of day.

Method: Solar geometry (Duffie and Beckman, Solar Engineering of Thermal Processes, ch. 1)

Input parameters

Unit system: SI

Parameter	Value	Unit
Sloping length of the panel table	2.0000	m
Tilt of the panels	20.000	°
Latitude (north positive)	20.000	°
Solar declination on the design day −23.44° at the December solstice, +23.44° in June, 0° at the equinoxes.	-23.440	°
Hour angle (15° per hour from solar noon)	45.000	°

Calculated results

Parameter	Value	Unit
Height of the top edge above the bottom edge	0.68404	m
Solar altitude	28.267	°
Solar azimuth from the equator direction	47.442	°
Clear gap between rows	0.86041	m
Row pitch (gap plus the plan length of the table)	2.7398	m

Notes for this case

- Rows facing the equator on level ground. The usual design case is the winter solstice at 9 am or 3 pm solar time (hour angle 45°).

Formula and method

$$\sin\alpha = \sin\varphi\sin\delta + \cos\varphi\cos\delta\cos\omega$$

$$\tan\gamma = \frac{\sin\omega\cos\delta}{\cos\omega\cos\delta\sin\varphi - \sin\delta\cos\varphi}$$

$$d = \frac{L\sin\beta}{\tan\alpha}\cos\gamma, \quad p = d + L\cos\beta$$

Variables

L	Sloping length of the panel table	m
β	Tilt of the panels	rad
φ	Latitude (north positive)	rad
δ	Solar declination on the design day	rad
ω	Hour angle (15° per hour from solar noon)	rad
h	Height of the top edge above the bottom edge	m
α	Solar altitude	rad
γ	Solar azimuth from the equator direction	rad
d	Clear gap between rows	m
p	Row pitch (gap plus the plan length of the table)	m

Method and standards

Sun position from latitude, declination and hour angle; shadow of the top edge projected on the row direction.

Assumptions and limits

- Level ground, rows facing the equator.
- Shading is checked at one instant, the hour angle you enter. The sun path is symmetric about solar noon, so 9 am and 3 pm give the same spacing; enter the hour angle as a positive number.
- The calculation stops when the sun is less than about 1° above the horizon (sin α ≤ 0.02), a practical cut-off: rows cannot be spaced for a sun that low.

References

- Solar geometry (Duffie and Beckman, Solar Engineering of Thermal Processes, ch. 1)

Report details

Report reference	FCC-V6BK-E41C (the same inputs always give the same reference)
Generated	17 November 2026, 19:48 UTC
Calculator	Solar Panel Row Spacing to Avoid Shading
Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 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/electrical/solar-pv/pv-row-spacing

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.