Beam Angle, Spot Diameter and Illuminance of a Spotlight

Spot diameter at a throw distance from a lamp's beam angle, the beam solid angle, mean luminous intensity and the illuminance in the spot.

Method: Cone geometry and solid angle; Lighting Handbook practice (lumen method, maintenance factor components)

Input parameters

Unit system: SI

Parameter	Value	Unit
Lamp luminous flux (lm)	800.00	
Share of flux inside the beam angle	80.000	%
Beam angle (full)	36.000	°
Throw distance	3.0000	m

Calculated results

Parameter	Value	Unit
Spot diameter	1.9495	m
Beam solid angle (sr)	0.30752	
Mean intensity in the beam (cd)	2,081.2	
Centre illuminance (I/d²)	231.24	lx
Average illuminance over the spot	214.41	lx

Notes for this case

- Beam angle is the full angle where intensity falls to 50 % of peak; the real centre intensity is higher than this mean. Use the maker's peak candela (CBCP) for accurate centre illuminance.

Formula and method

$$D = 2d\tan\frac{\theta}{2}, \quad \Omega = 2\pi\left(1-\cos\frac{\theta}{2}\right), \quad I = \frac{\eta_b \Phi}{\Omega}$$

Variables

Φ	Lamp luminous flux (lm)	-
η_b	Share of flux inside the beam angle	-
θ	Beam angle (full)	rad
d	Throw distance	m
D	Spot diameter	m
Ω	Beam solid angle (sr)	-
I	Mean intensity in the beam (cd)	-
E_c	Centre illuminance (I/d²)	lx
E_{avg}	Average illuminance over the spot	lx

Method and standards

Beam geometry.

Assumptions and limits

- Uniform intensity within the beam (mean value).

References

Cone geometry and solid angle, Lighting Handbook practice (lumen method, maintenance factor components)

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/electrical/lighting/beam-angle-spot-diameter

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.