Mean Radiant Temperature from a Black Globe Thermometer

Mean radiant temperature from globe temperature, air temperature and air speed, with forced or natural convection on the globe, for a standard or any globe size.

Method: Globe thermometer heat balance (the ISO 7726 method)

Input parameters

Unit system: SI

Parameter	Value	Unit
Globe temperature	30.000	°C
Air temperature	25.000	°C
Air speed at the globe	0.30000	m/s
Globe diameter (standard 150 mm)	150.00	mm
Globe emissivity (matt black 0.95)	95.000	%

Calculated results

Parameter	Value	Unit
Mean radiant temperature	35.302	°C
Forced-convection coefficient on the globe	6.5340	W/(m²·K)
Natural-convection coefficient on the globe	3.3639	W/(m²·K)
Operative temperature (mean of air and radiant)	30.151	°C

Notes for this case

- Globe heat balance: radiation from the surroundings equals convection to the air at steady state; the larger of the forced and natural coefficients is used. Let the globe settle for 20–30 minutes.

Formula and method

$$\bar{t}_r = \left[t_g^4 + \frac{h_{cg}}{\varepsilon_g \sigma} (t_g - t_a) \right]^{1/4}, \quad h_{cg} = \max\left(6.3 \frac{v_a^{0.6}}{D^{0.4}},\ 1.4 \left(\frac{|t_g - t_a|}{D} \right)^{1/4} \right)$$

Variables

t_g	Globe temperature	K
t_a	Air temperature	K
v_a	Air speed at the globe	m/s
D	Globe diameter (standard 150 mm)	m
ε_g	Globe emissivity (matt black 0.95)	-
$\bar{t}_r$	Mean radiant temperature	K
$h_{cg,forced}$	Forced-convection coefficient on the globe	W/(m²·K)
$h_{cg,natural}$	Natural-convection coefficient on the globe	W/(m²·K)
t_o	Operative temperature (mean of air and radiant)	K

Method and standards

Globe thermometer heat balance (absolute temperatures).

Assumptions and limits

- Steady state, uniform air speed over the globe.

References

Globe thermometer heat balance (the ISO 7726 method)

Report details

Report reference	FCC-H9PH-WACW (the same inputs always give the same reference)
Generated	23 November 2026, 17:50 UTC
Calculator	Mean Radiant Temperature from a Black Globe Thermometer
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/hvac/loads/globe-mean-radiant-temperature

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.