Two-Colour (Ratio) Pyrometer: True Temperature from Emissivity Ratio

True temperature from a two-colour pyrometer reading when the target is not grey, from the two wavelengths and the ratio of emissivities (Wien approximation).

Method: Ratio pyrometry with Wien's approximation: 1/T = 1/T_r + ln(ε₁/ε₂)/(c₂(1/λ₁ − 1/λ₂))

Input parameters

Unit system: SI

Parameter	Value	Unit
Ratio temperature indicated	1,200.0	°C
Shorter wavelength	0.90000	µm
Longer wavelength	1.0500	µm
Emissivity ratio	1.0500	

Calculated results

Parameter	Value	Unit
True temperature	1,155.1	°C
Indication error	44.949	K

Notes for this case

• Wien approximation (valid for λT below about 3,000 µm·K). Ratio pyrometers tolerate dust, smoke and partial targets as long as the emissivity ratio stays near 1.

Formula and method

$$\frac{1}{T} = \frac{1}{T_r} + \frac{\ln(\varepsilon_1/\varepsilon_2)}{c_2\left(\frac{1}{\lambda_1} - \frac{1}{\lambda_2}\right)}, \quad c_2 = 0.014388\ \mathrm{m\,K}$$

Variables

T_r	Ratio temperature indicated	K
λ_1	Shorter wavelength	m
λ_2	Longer wavelength	m
$\varepsilon_1/\varepsilon_2$	Emissivity ratio	-
T	True temperature	K
$T_r - T$	Indication error	K

Method and standards

Wien ratio pyrometry.

Assumptions and limits

- Wien's approximation is within about 1 % of Planck's law for λT below about 3,000 µm·K; the page warns when the longer wavelength times the temperature exceeds that.
- Wien approximation.

References

• Ratio pyrometry with Wien's approximation: 1/T = 1/T_r + ln(ε₁/ε₂)/(c₂(1/λ₁ − 1/λ₂))

Report details

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Release checks	2 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/instrumentation/temperature/two-colour-pyrometer

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.