Thermal Expansion: Length, Area and Volume Change

Change in length, area and volume of a solid from its linear expansion coefficient and temperature change, with the final dimensions and the volume coefficient.

Method: Linear thermal expansion ΔL = α L_0 ΔT (small strain)

Input parameters

Unit system: SI

Parameter	Value	Unit
Initial length	10.000	m
Linear expansion coefficient	12.000	µm/(m·K)
Initial temperature	20.000	°C
Final temperature	300.00	°C
Initial volume (for the volume change)	1.0000	m³

Calculated results

Parameter	Value	Unit
Change in length α L_0 ΔT	33.600	mm
Final length	10.034	m
Volume coefficient 3α	36.000	µm/(m·K)
Change in volume	0.010080	m³
Relative change in area 2α ΔT	0.67200	%

Notes for this case

• Constant mean coefficient over the range; for wide ranges use the material's mean coefficient between the two temperatures. Small-strain forms (3α, 2α).

Formula and method

$$\Delta L = \alpha L_0 \Delta T, \quad \beta \approx 3\alpha, \quad \Delta V = \beta V_0 \Delta T$$

Variables

L_0	Initial length	m
α	Linear expansion coefficient	1/K
T_1	Initial temperature	K
T_2	Final temperature	K
V_0	Initial volume (for the volume change)	m³
ΔL	Change in length α L_0 ΔT	m
L	Final length	m
β	Volume coefficient 3α	1/K
ΔV	Change in volume	m³
$\Delta A/A$	Relative change in area 2α ΔT	-

Method and standards

Linear expansion.

Assumptions and limits

- Isotropic solid.

References

- Linear thermal expansion ΔL = α L_0 ΔT (small strain)

Report details

Report reference	FCC-AP6X-BJJS (the same inputs always give the same reference)
Generated	17 November 2026, 19:45 UTC
Calculator	Thermal Expansion: Length, Area and Volume Change
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/materials/properties/thermal-expansion-linear-volume

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.