

Thermal expansion report

Sample document with complete example values. It shows the report the purchased export produces for YOUR input - it is not itself a report for any part.

Project: Sample project

Part/Position: no real part

Prepared by: Sample, not released

Overall assessment: not rated - with free thermal expansion there is no limit to check against. No stress arises; the result of this case is the length change.

Task

Calculated

One part: length change

Part

Material	S235JR
Expansion coefficient α	$12 \cdot 10^{-6}/\text{K}$
Length L	1,000 mm

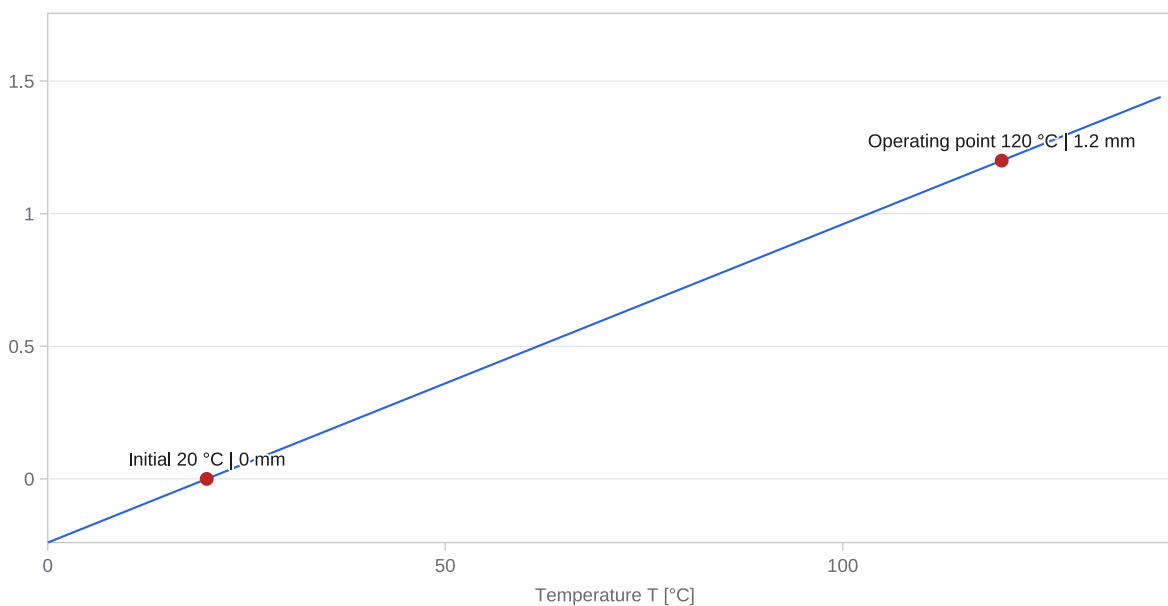
Temperature

Initial temperature T_0	20 °C
Final temperature T_1	120 °C
Temperature difference ΔT	100 K

Results

Length change ΔL	1.2 mm
Length at T_1	1,001.2 mm
Area change $\Delta A/A$	0.2401 %
Volume change $\Delta V/V$	0.3604 %

Length change $\Delta L(T)$ [mm]



The length change grows linearly with temperature. The curve is extended beyond the range considered so that its direction stays visible.

Basis of calculation

Free thermal expansion from $\Delta L = \alpha \cdot L \cdot \Delta T$ with $\Delta T = T_1 - T_0$. Area and volume change are formed exactly from the length ratio, that is $\Delta A/A = (1 + \alpha \cdot \Delta T)^2 - 1$ and $\Delta V/V = (1 + \alpha \cdot \Delta T)^3 - 1$, and not through the common approximations $2 \cdot \alpha \cdot \Delta T$ and $3 \cdot \alpha \cdot \Delta T$. For a pair the clearance follows from $s(T) = s_0 + (\alpha_o \cdot L_o - \alpha_i \cdot L_i) \cdot (T - T_0)$, and the temperature at which it is used up from $T = T_0 - s_0 / (\alpha_o \cdot L_o - \alpha_i \cdot L_i)$. If that lies below absolute zero the case does not occur. The calculation assumes an expansion coefficient held constant over the temperature range, unrestrained expansion and a temperature constant across the section. No stress therefore arises - if the expansion is restrained, $\sigma_{th} = -E \cdot \alpha \cdot \Delta T$ applies and the verification belongs to the axial bar calculator. Residual stress, creep and phase changes are not considered; the tabulated coefficients are mean values for the range around room temperature.

About this sample

All values on these pages come from a freely chosen example calculation and belong to no real part. The purchased export contains the same sections with your input, your header data (project, part, prepared by) and as searchable text. Pricing and scope: maschinenbaurechner.de/en/pricing

Note: The results are design and orientation aids. They do not replace independent verification, calculation and approval by a qualified person. The terms of use at maschinenbaurechner.de apply.