Torsion Verification

> **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: OK - the available safety margin against the shear yield limit meets the required safety margin.

Load and System

Torque T	500 Nm
Bar length L	1,000 mm
Shear modulus G	81,000 N/mm²
Yield strength Re	355 N/mm²
Required safety factor S_req	1.5
Governing hypothesis	GEH - von Mises, $\tau_F = Re/\sqrt{3}$
Guide value for specific twist	0.25 °/m

Cross-Section

Cross-Section	Solid circle, d = 65 mm
Torsion section modulus W_t	53,922 mm³
Torsion constant I_t	1,752,481 mm⁴

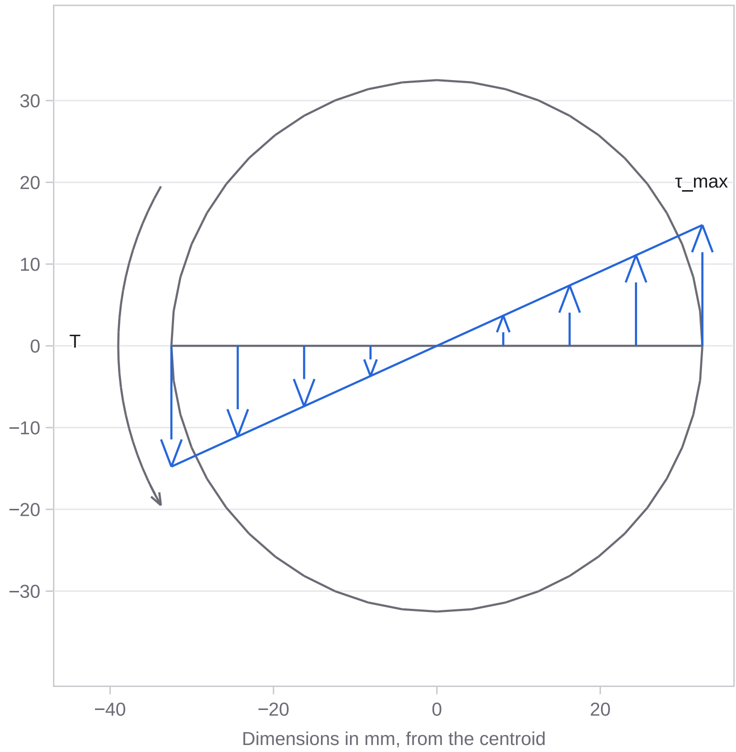
Results

Torsional shear stress $\tau = T/W_t$	9.27 N/mm²
Angle of twist $\varphi = T \cdot L/(G \cdot I_t)$	0.00352 rad = 0.202°
Specific twist	0.202 °/m
Shear yield limit τ_F	204.96 N/mm²
Allowable shear stress $\tau_{allow} = \tau_F/S_{req}$	136.64 N/mm²

Verification

Criterion	Value	Limit	Status
Shear safety $S = \tau_F/\tau$	22.1	1.5	● OK
|Specific twist| against the guide value	0.202 °/m	0.25 °/m	● within guide value

Cross-section and shear stress



τ grows linearly from zero at the axis to τ_max at the edge; the arrows are perpendicular to the diameter and their tips lie on the envelope.

Calculation basis

Torsion of straight prismatic bars per St. Venant's torsion theory with free warping. The maximum torsional shear stress follows from $\tau = T/W_t$, the angle of twist from $\varphi = T \cdot L/(G \cdot I_t)$. For solid circular and circular-tube sections, W_t and I_t are exact; for thin-walled closed profiles, the first and second Bredt formulas apply ($W_t = 2 \cdot A_m \cdot t$, $I_t = 4 \cdot A_m^2 \cdot t/U$); for solid rectangular sections, the exact St. Venant series applies. The verification compares τ with the shear yield limit τ_F for the SELECTED hypothesis: GEH (von Mises) uses Re/sqrt3, SH (Tresca) uses Re/2, which is 15.5 % lower. Which one was used is stated in the input list above. Warping restraint, notch effects and stability are not considered.

Specific twist: this is a question of serviceability and is therefore classified against a guide value, not verified against a standard. Roloff/Matek (18th ed., p. 358) gives 0.25 to 0.5 degrees per metre for gearbox and machine shafts and treats the stiffness check explicitly as the second step after the stress check. That row therefore carries the guide-value wording (within guide value / close to guide value / outside guide value) and not the wording of a verification. Where the twist itself disturbs the function (indexing, angular position, vibration), your own value applies.

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.