Convection / Forced Heat Transfer

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

Application: Rohrkühler

Heat transfer coefficient α = 75.1 W/(m²·K) (Gnielinski (more accurate), turbulent flow).

Fluid properties

Fluid	Luft (1 bar)
Density ρ	1.079 kg/m³
Kin. viscosity ν	18.25 mm²/s
Thermal conductivity λ	0.0279 W/(m·K)
Specific heat capacity c_p	1,007 J/(kg·K)
Prandtl number Pr	0.711

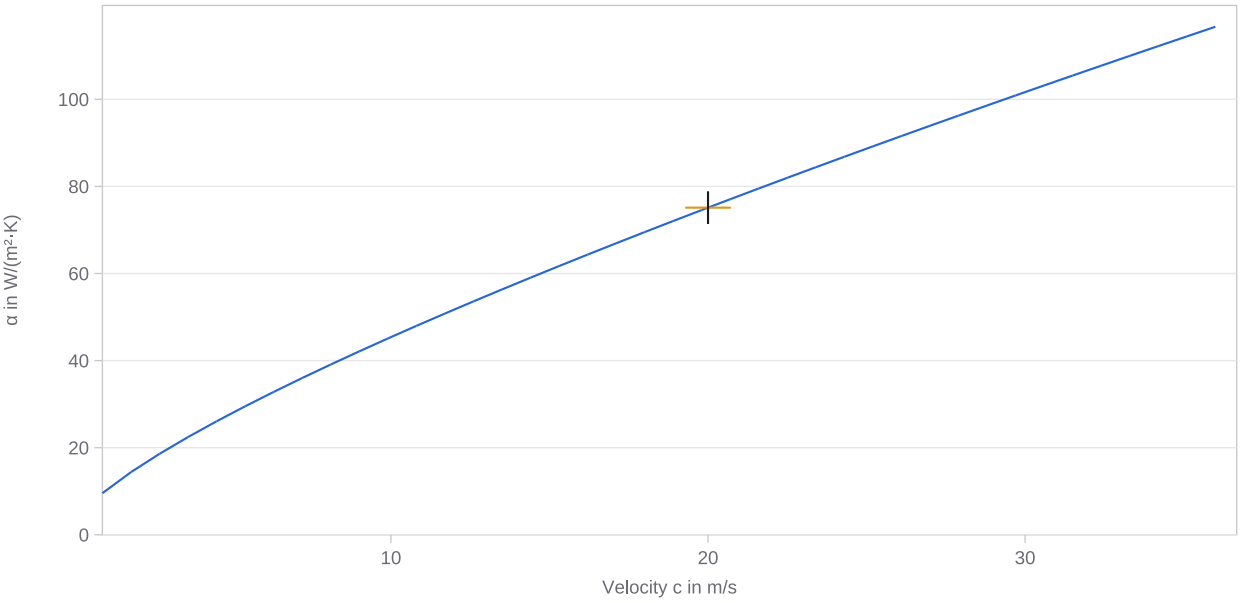
Flow and geometry

Velocity c	20 m/s
Characteristic length d	25 mm
Reynolds number Re	27,397
Flow regime	turbulent
Pipe length L	1.5 m
Ratio L/d	60

Result: heat transfer

Quantity	Value	Unit
Correlation used	Gnielinski (more accurate)	-
Nusselt number Nu	67.31	-
Heat transfer α	75.1	W/(m²·K)
Dittus-Boelter comparison (Nu)	71.22	-
Gnielinski comparison (Nu)	67.31	-
Area A = π·d·L	0.1178	m²
Heat flow Q = α·A·ΔT	265.5	W (ΔT = 30 K)

Heat transfer coefficient over flow velocity



Calculation basis

Dimensionless numbers Re = c·d/ν, Pr = η·c_p/λ (η = ρ·ν), Nu = α·d/λ. From Re and Pr an empirical correlation gives the Nusselt number, and from that α = Nu·λ/d; the heat flow is Q = α·A·ΔT.

Correlations for forced pipe flow: Dittus-Boelter Nu = 0.023·$Re^{0.8}$·Pr^{n} (n = 0.4 heating, 0.3 cooling) as the robust standard, valid for ~Re > 10^4, 0.6 < Pr < 160, L/d > 10; Gnielinski as the accuracy option; laminar (Re < 2300) Nu = 3.66. The empirical correlations scatter by a few percent depending on the source - for a precise design use fluid properties at the mean temperature and observe manufacturer data.

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