Shell-and-Tube Exchanger: Tube-Side Velocity and Reynolds Number

Tube-side velocity and Reynolds number of a shell-and-tube exchanger from flow, fluid properties, tube bore, tube count and passes.

Method: Continuity per pass v = ṁ/(ρ (N/n_p) π d_i²/4)

Input parameters

Unit system: SI

Parameter	Value	Unit
Tube-side mass flow	108,000	kg/h
Fluid density	995.00	kg/m³
Fluid viscosity	8.0000e-04	Pa·s
Tube inside diameter	15.750	mm
Number of tubes	292.00	
Tube passes	2.0000	

Calculated results

Parameter	Value	Unit
Tube-side velocity	1.0600	m/s
Reynolds number	20,764	

Notes for this case

- Typical liquid velocities are 1–2.5 m/s to limit fouling without erosion; your design guide decides.

Formula and method

$$v = \frac{\dot{m}}{\rho \frac{N}{n_p} \frac{\pi d_i^2}{4}}, \quad Re = \frac{\rho v d_i}{\mu}$$

Variables

$\dot{m}$	Tube-side mass flow	kg/s
ρ	Fluid density	kg/m³
μ	Fluid viscosity	Pa·s
d_i	Tube inside diameter	m
N	Number of tubes	-
n_p	Tube passes	-
v	Tube-side velocity	m/s
Re	Reynolds number	-

Method and standards

Continuity.

Assumptions and limits

- Equal flow in every tube.

References

- Continuity per pass v = ṁ/(ρ (N/n_p) π d_i²/4)

Report details

Report reference	FCC-QCNT-FTYJ (the same inputs always give the same reference)
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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/chemical/process-heat-exchangers/tube-side-velocity

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.