Reynolds Number and Flow Regime in a Pipe

Reynolds number from velocity, diameter, density and viscosity, with the flow regime (laminar, transition, turbulent) and the Darcy friction factor (Colebrook).

Method: Colebrook–White (1939); Moody (1944)

Input parameters

Unit system: SI

Parameter	Value	Unit
Mean velocity	2.0000	m/s
Inside diameter (or hydraulic diameter)	102.30	mm
Fluid density	998.20	kg/m³
Dynamic viscosity	1.0020	cP
Absolute roughness of the wall Commercial steel about 0.045 mm; drawn tubing 0.0015 mm; cast iron 0.26 mm.	0.045000	mm

Calculated results

Parameter	Value	Unit
Reynolds number	203,824	
Regime: 0 laminar, 1 transition, 2 turbulent	2.0000	
Darcy friction factor	0.018472	
Kinematic viscosity	1.0038e-06	m²/s

Formula and method

$$Re = \frac{\rho v D}{\mu} \qquad \nu = \frac{\mu}{\rho} \qquad f = \frac{64}{Re}\ (Re < 2300) \qquad \frac{1}{\sqrt{f}} = -2\log_{10}\left(\frac{\epsilon/D}{3.7} + \frac{2.51}{Re\sqrt{f}}\right)$$

Variables

v	mean velocity	m/s
D	inside diameter	m
ρ	density	kg/m³
μ	dynamic viscosity	Pa·s
ϵ	absolute roughness	m
Re	Reynolds number	–
regime	0 laminar, 1 transition, 2 turbulent	–
f	Darcy friction factor	–
ν	kinematic viscosity	m²/s

Method and standards

Reynolds number by definition; Darcy friction factor 64/Re in laminar flow and Colebrook–White above (used also in transition, conservatively).

Assumptions and limits

- Full circular pipe; Newtonian fluid.

References

• Colebrook–White (1939); Moody (1944)

Report details

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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/mechanical/fluid-mechanics/reynolds-number

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.