Steam Pipe Pressure Drop

Pressure drop of a steam line by Darcy–Weisbach and Colebrook, with steam density and viscosity from IAPWS-IF97, fittings by K, velocity and Reynolds number.

Method: Darcy–Weisbach equation; Colebrook (1939); ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Steam flow	10,000	kg/h
Steam pressure at the inlet (absolute)	10.500	bar
Steam condition	Dry saturated	
Steam temperature (superheated only)	250.00	°C
Pipe inside diameter	154.10	mm
Pipe length	100.00	m
Wall roughness Commercial steel 0.045 mm (Moody).	0.045000	mm
Sum of fitting loss coefficients	5.0000	

Calculated results

Parameter	Value	Unit
Pressure drop	30.786	kPa
Pressure drop as a share of inlet pressure	2.9320	%
Velocity	27.628	m/s
Reynolds number	1,524,608	
Darcy friction factor	0.015353	
Steam density	5.3907	kg/m³
Steam viscosity	0.015054	cP

Formula and method

$$u = \frac{4\,\dot{m}}{\rho\,\pi D^2} \qquad Re = \frac{\rho\,u\,D}{\mu} \qquad \Delta p = \left(f\,\frac{L}{D} + \Sigma K\right)\frac{\rho\,u^2}{2}$$

$$\frac{1}{\sqrt{f}} = -2\log_{10}\left(\frac{\varepsilon/D}{3.7} + \frac{2.51}{Re\sqrt{f}}\right)$$

Variables

$\dot{m}$	steam flow	kg/s
p	steam pressure at the inlet, absolute	Pa
state	dry saturated or superheated steam	–
T_s	steam temperature (superheated)	K
D	pipe inside diameter	m
L	pipe length	m
ε	wall roughness	m
ΣK	sum of fitting loss coefficients	–
Δp	pressure drop	Pa

$\Delta p/p$	pressure drop as a share of inlet pressure	–
u	velocity	m/s
Re	Reynolds number	–
f	Darcy friction factor	–
ρ	steam density	kg/m³
μ	steam viscosity	Pa·s

Method and standards

Darcy–Weisbach with the Colebrook–White friction factor, at the inlet steam state. Steam density from IAPWS-IF97 and viscosity from the IAPWS 2008 release, both FireCAD implementations.

Assumptions and limits

- Constant density along the line (inlet state): valid for drops up to about 10 % of the inlet pressure; between 5 and 10 % the page notes that the result is a few per cent low.
- The velocity is compared with the speed of sound at the inlet (IF97); above Mach 0.3 the page warns that compressibility matters.
- Dry steam; condensate in the line raises the drop.
- No change of elevation (negligible for steam).

References

- Darcy–Weisbach equation
- Colebrook (1939)
- IAPWS R7-97(2012) IF97
- IAPWS 2008 (viscosity)

Report details

Report reference	FCC-FK1V-XM1Y (the same inputs always give the same reference)
Generated	17 November 2026, 19:35 UTC
Calculator	Steam Pipe Pressure Drop
Method last reviewed	10 November 2026
Software release	FireCAD Calc, release of 17 November 2026
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/piping/steam-pipe-pressure-drop

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.