Compressed Air Pipe Pressure Drop

Pressure drop and velocity in a compressed air main from free air flow, line pressure and temperature, pipe size and equivalent length.

Method: Darcy–Weisbach with Colebrook (FireCAD engine); Sutherland air viscosity

Input parameters

Unit system: SI

Parameter	Value	Unit
Free air flow (at 1.01325 bar, 20 °C)	10.000	m³/min
Line pressure (absolute)	8.0000	bar
Air temperature in the line	30.000	°C
Pipe inside diameter	52.500	mm
Equivalent length	150.00	m
Roughness	0.045000	mm

Calculated results

Parameter	Value	Unit
Air density in the line	9.1934	kg/m³
Velocity	10.084	m/s
Reynolds number	261,561	
Pressure drop	0.26887	bar
Drop as a share of line pressure	3.3608	%

Notes for this case

- Velocity above about 8 m/s in a main: expect noise and carry-over of condensate.

Formula and method

$$\dot{m} = \rho_{ref}\dot{V}_{FAD}, \quad v = \frac{\dot{m}}{\rho\pi d^2/4}, \quad \Delta p = f_D\frac{L}{d}\frac{\rho v^2}{2}$$

Variables

$\dot{V}_{FAD}$	Free air flow (at 1.01325 bar, 20 °C)	m³/s
p	Line pressure (absolute)	Pa
T	Air temperature in the line	K
d	Pipe inside diameter	m
L	Equivalent length	m
ε	Roughness	m
ρ	Air density in the line	kg/m³
v	Velocity	m/s
Re	Reynolds number	-
Δp	Pressure drop	Pa
$\Delta p/p$	Drop as a share of line pressure	-

Method and standards

Pipe friction at line density.

Assumptions and limits

- Small drop relative to pressure; isothermal.
- The free air flow is referred to 1.01325 bar and 20 °C. A compressor FAD to ISO 1217 is at the actual inlet conditions: convert it to this reference first (see the FAD altitude and temperature correction).
- Relative roughness outside the range of the Colebrook equation is rejected.

References

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Report details

Report reference	FCC-1WQW-73NR (the same inputs always give the same reference)
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Software release	FireCAD Calc, release of 17 November 2026
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/mechanical/compressors/compressed-air-pipe-pressure-drop

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.