Gas Velocity in a Pipeline and Erosional Velocity

Actual gas velocity at a pressure and temperature from the flow at base conditions, the erosional velocity limit C/√ρ, and the ratio between them.

Method: Menon; Gas Pipeline Hydraulics (CRC Press, 2005); ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Gas flow at base conditions	7,079,212	m³/d
Gas pressure (absolute)	6,996.1	kPa
Gas temperature	15.556	°C
Compressibility factor	0.90000	
Gas gravity (air = 1)	0.60000	
Pipe inside diameter	482.60	mm
Erosional constant (US customary, 100 for continuous service)	100.00	
Base temperature	15.000	°C
Base pressure	101.33	kPa

Calculated results

Parameter	Value	Unit
Gas density at flowing conditions	56.279	kg/m³
Gas velocity	5.8499	m/s
Erosional velocity	16.261	m/s
Velocity as a share of erosional	35.974	%

Notes for this case

• Menon recommends operating at no more than about half the erosional velocity. The constant C = 100 (US customary units) is the usual value for continuous service in clean gas; solids or liquids call for a lower velocity.

Formula and method

$$\rho = \frac{P G M_{air}}{Z R T}, \quad u = \frac{Q_b}{A}\frac{P_b}{P}\frac{T}{T_b}Z, \quad u_{max} = \frac{C}{\sqrt{\rho}} \ (\mathrm{ft/s},\ \rho \text{ in } \mathrm{lb/ft^3})$$

Variables

Q_b	Gas flow at base conditions	m³/s
P	Gas pressure (absolute)	Pa
T	Gas temperature	K
Z	Compressibility factor	-
G	Gas gravity (air = 1)	-
D	Pipe inside diameter	m
C	Erosional constant (US customary, 100 for continuous service)	-
T_b	Base temperature	K
P_b	Base pressure	Pa
ρ	Gas density at flowing conditions	kg/m³
u	Gas velocity	m/s
u_{max}	Erosional velocity	m/s

u/u_{max}	Velocity as a share of erosional	-

Method and standards

Gas law and the erosional velocity relation as given by Menon (C = 100). Air molar mass 28.9647 kg/kmol.

Assumptions and limits

- Z = 1 at base conditions; ideal mixing rule for gravity.

References

- Menon
- Gas Pipeline Hydraulics (CRC Press, 2005)
- ch. 2
- eqs. 2.24–2.31

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

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Reopens the calculator with the inputs of this report.