Gas Pipeline Inlet Pressure by the AGA Transmission Factor

Inlet pressure a gas pipeline needs for a flow and delivery pressure, using the AGA fully and partially turbulent transmission factors and the general flow equation.

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Gas flow at base conditions	6,000,000	m^3/d
Delivery pressure (absolute)	5,000.0	kPa
Pipe inside diameter	476.00	mm
Pipe length	60.000	km
Pipe roughness	0.020000	mm
Pipe drag factor (bends and fittings)	0.96000	
Inlet elevation	0	m
Outlet elevation	0	m
Gas gravity (air = 1)	0.60000	
Gas viscosity	0.012000	cP
Average gas temperature	20.000	°C
Compressibility factor	0.85000	
Base temperature	15.000	°C
Base pressure	101.33	kPa

Calculated results

Parameter	Value	Unit
Reynolds number	1.1378e+07	
Fully turbulent transmission factor	19.779	
Von Kármán smooth-pipe transmission factor	22.236	
Partially turbulent transmission factor	21.347	
AGA transmission factor (smaller of the two)	19.779	
Darcy friction factor, $4/F^2$	0.010225	
Inlet pressure needed (absolute)	6,135.7	kPa

Notes for this case

- The fully turbulent (rough pipe) factor governs.
- Z should be taken at the average pressure; repeat with Z at the new average pressure if the inlet pressure changed much. Drag factor about 0.96 for an average bend index of 60–80°.

Formula and method

$$F_r = 4\log_{10}\frac{3.7D}{e}, \quad F_t = 4\log_{10}\frac{Re}{F_t} - 0.6, \quad F_p = 4D_f\log_{10}\frac{Re}{1.4125F_t}$$

$$Q_b = 5.747 \times 10^{-4} F \frac{T_b}{P_b} \left(\frac{P_1^2 - e^s P_2^2}{G T_f L_e Z} \right)^{0.5} D^{2.5}$$

Variables

Q_b	Gas flow at base conditions	m³/s
P_2	Delivery pressure (absolute)	Pa
D	Pipe inside diameter	m
L	Pipe length	m
e	Pipe roughness	m
D_f	Pipe drag factor (bends and fittings)	-
H_1	Inlet elevation	m
H_2	Outlet elevation	m
G	Gas gravity (air = 1)	-
μ	Gas viscosity	Pa·s
T_f	Average gas temperature	K
Z	Compressibility factor	-
T_b	Base temperature	K
P_b	Base pressure	Pa
Re	Reynolds number	-
F_r	Fully turbulent transmission factor	-
F_t	Von Kármán smooth-pipe transmission factor	-
F_p	Partially turbulent transmission factor	-
F	AGA transmission factor (smaller of the two)	-
f	Darcy friction factor, 4/F²	-
P_1	Inlet pressure needed (absolute)	Pa

Method and standards

AGA NB-13 transmission factors in the general flow equation, in Menon's SI form (Q m³/day, P kPa, D mm, L km, T K; Re = 0.5134 (P_b/T_b)(GQ/μD) with μ in poise).

Assumptions and limits

- Steady isothermal flow; single slope.

References

- Menon
- Gas Pipeline Hydraulics (CRC Press, 2005)
- ch. 2
- eqs. 2.8
- 2.35 and 2.48–2.51 (AGA NB-13 method)

Report details

Report reference	FCC-6Y0G-APVQ (the same inputs always give the same reference)
Generated	17 November 2026, 19:37 UTC
Calculator	Gas Pipeline Inlet Pressure by the AGA Transmission Factor
Method last reviewed	17 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.

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