Gas Pipeline Compressor Station Spacing

Spacing between compressor stations and the number needed on a gas pipeline from maximum pressure, compression ratio and delivery pressure (general flow equation).

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

Input parameters

Unit system: SI

Parameter	Value	Unit
Gas flow at base conditions	1.5000e+07	m³/d
Pipe inside diameter	590.00	mm
Total pipeline length	400.00	km
Transmission factor	20.000	
Gas gravity (air = 1)	0.60000	
Average gas temperature	20.000	°C
Compressibility factor	0.88000	
Station discharge pressure (absolute, at most the MAOP)	8,400.0	kPa
Compression ratio	1.4000	
Delivery pressure required (absolute)	4,000.0	kPa
Base temperature	15.000	°C
Base pressure	101.33	kPa

Calculated results

Parameter	Value	Unit
Station suction pressure	6,000.0	kPa
Spacing between stations	75.801	km
Longest last section that still delivers at P_del	119.67	km
Compressor stations needed (including the first)	5.0000	

Notes for this case

- Flat route, one transmission factor and temperature; stations are spaced so each discharges at P_d and the next receives at P_d/r. Refine locations with the elevation profile and fuel use.

Formula and method

$$K = G T_f Z \left(\frac{Q_b}{5.747 \times 10^{-4} F \frac{T_b}{P_b} D^{2.5}} \right)^2, \quad L_s = \frac{P_d^2 - (P_d/r)^2}{K}, \quad L_{last} = \frac{P_d^2 - P_{del}^2}{K}$$

Variables

Q_b	Gas flow at base conditions	m³/s
D	Pipe inside diameter	m
L_t	Total pipeline length	m
F	Transmission factor	-
G	Gas gravity (air = 1)	-
T_f	Average gas temperature	K
Z	Compressibility factor	-

P_d	Station discharge pressure (absolute, at most the MAOP)	Pa
r	Compression ratio	-
P_{del}	Delivery pressure required (absolute)	Pa
T_b	Base temperature	K
P_b	Base pressure	Pa
P_s	Station suction pressure	Pa
L_s	Spacing between stations	m
L_{last}	Longest last section that still delivers at P_del	m
n	Compressor stations needed (including the first)	-

Method and standards

General flow equation solved for length between pressure limits (Menon's SI form).

Assumptions and limits

- Flat route; constant F, Z and T.

References

• Menon
• Gas Pipeline Hydraulics (CRC Press, 2005)
• ch. 4.1 (compressor station locations) with the general flow equation 2.6

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

https://calc.firecad.com/chemical/oil-gas/gas-compressor-station-spacing

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.