Gas Well Rate at Pseudo-Steady State (Pressure-Squared Method)

Gas well rate from permeability, pay, reservoir and bottom-hole pressures, temperature, gas viscosity, Z, drainage radius and skin by the pressure-squared equation.

Input parameters

Unit system: SI

Parameter	Value	Unit
Gas permeability	12.000	mD
Net pay thickness	25.000	ft
Average reservoir pressure	1,800.0	psi
Flowing bottom-hole pressure	1,100.0	psi
Reservoir temperature	175.00	°F
Gas viscosity at the mean pressure	0.016000	cP
Gas compressibility factor at the mean pressure	0.85000	
Drainage radius	1,490.0	ft
Wellbore radius	0.35400	ft
Skin factor	4.0000	

Calculated results

Parameter	Value	Unit
Gas rate (standard)	4,277.9	Mscf/d
Pressure at which to evaluate μ and Z	1,491.6	psi
Open-flow rate (p_wf = 0)	6,827.7	Mscf/d

Notes for this case

- The pressure-squared form is accurate below about 2,000 psia; at higher pressures use real-gas pseudo-pressure. μ and Z are taken at the mean pressure shown. Non-Darcy flow (turbulence) is not included; add it as a rate-dependent skin.

Formula and method

$$Q_g = \frac{\pi k h\, T_n (\bar{p}_r^2 - p_{wf}^2)}{p_n T \mu_g Z [\ln(r_e/r_w) - 0.75 + s]}$$

Variables

k	Gas permeability	m²
h	Net pay thickness	m
$\bar{p}_r$	Average reservoir pressure	Pa
p_{wf}	Flowing bottom-hole pressure	Pa
T	Reservoir temperature	K
μ_g	Gas viscosity at the mean pressure	Pa·s
Z	Gas compressibility factor at the mean pressure	-
r_e	Drainage radius	m
r_w	Wellbore radius	m
s	Skin factor	-

Q_g	Gas rate (standard)	Nm³/s
$\bar{p}$	Pressure at which to evaluate μ and Z	Pa
Q_{max}	Open-flow rate (p_wf = 0)	Nm³/s

Method and standards

Real-gas radial flow at pseudo-steady state.

Assumptions and limits

- Laminar flow; μZ nearly constant.

Report details

Report reference	FCC-C66E-BQKE (the same inputs always give the same reference)
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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/reservoir-engineering/gas-well-pseudosteady-rate

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.