Critical Oil Rate for Gas and Water Coning (Meyer–Garder)

Maximum oil rate without gas coning, water coning, or both together (Meyer–Garder and Pirson), from densities, permeability, pay and perforated interval.

Input parameters

Unit system: SI

Parameter	Value	Unit
Coning case	Bottom water below (water coning)	
Effective oil permeability	93.500	mD
Oil viscosity	0.73000	cP
Oil formation volume factor	1.1000	
Oil density (reservoir)	47.500	lb/ft³
Water density (reservoir)	63.760	lb/ft³
Gas density (reservoir)	5.1000	lb/ft³
Oil column thickness	50.000	ft
Perforated interval	15.000	ft
Drainage radius	660.00	ft
Wellbore radius	0.25000	ft

Calculated results

Parameter	Value	Unit
Critical oil rate	13.443	bbl/d
Effective density difference	16.260	lb/ft³

Notes for this case

• Gas coning: perforations run from h_p above the oil–water contact up to D_t below the gas–oil contact (h_p = h − D_t). Water coning: h_p is measured down from the top of the formation. The critical rates are small; most wells produce above them and accept some coning.

Formula and method

$$Q_{oc} = \frac{\pi g k_o \Delta\rho \left(h^2 - h_p^2\right)}{\mu_o B_o \ln(r_e/r_w)}, \quad \Delta\rho_{both} = (\rho_w - \rho_o)\left(\frac{\rho_o - \rho_g}{\rho_w - \rho_g}\right)^2 + (\rho_o - \rho_g)\left(1 - \frac{\rho_o - \rho_g}{\rho_w - \rho_g}\right)^2$$

Variables

case	Coning case	-
k_o	Effective oil permeability	m²
μ_o	Oil viscosity	Pa·s
B_o	Oil formation volume factor	-
ρ_o	Oil density (reservoir)	kg/m³
ρ_w	Water density (reservoir)	kg/m³
ρ_g	Gas density (reservoir)	kg/m³
h	Oil column thickness	m
h_p	Perforated interval	m
r_e	Drainage radius	m

r_w	Wellbore radius	m
Q_{oc}	Critical oil rate	m^3/s
$\Delta\rho_{eff}$	Effective density difference	kg/m^3

Method and standards

Meyer–Garder critical rate.

Assumptions and limits

- Homogeneous isotropic reservoir; stable cone.

Report details

Report reference	FCC-2J88-JRR9 (the same inputs always give the same reference)
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Release checks	4 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/chemical/reservoir-engineering/coning-critical-rate-meyer-garder

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.