Oil Well Rate and Productivity Index (Radial Darcy Flow)

Oil well rate and productivity index from permeability, net pay, drawdown, viscosity, formation volume factor, drainage and well radius and skin.

Method: Ahmed; Reservoir Engineering Handbook; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Permeability	120.00	mD
Net pay thickness	7.6200	m
Reservoir pressure (average or at the drainage boundary)	2,506.0	psi
Flowing bottom-hole pressure	1,800.0	psi
Oil viscosity	2.5000	cP
Oil formation volume factor	1.2500	
Drainage radius	227.08	m
Wellbore radius	0.076200	m
Skin factor	0	
Flow regime	Steady state (constant boundary pressure)	

Calculated results

Parameter	Value	Unit
Oil rate (stock tank)	600.00	bbl/d
Productivity index	2.2682e-10	
Productivity index (stock-tank m³/d per bar)	1.9597	

Notes for this case

- Single-phase oil above the bubble point, homogeneous reservoir, centred well. Below the bubble point gas comes out of solution: use Vogel's inflow relation. J in the first output is in SI (m³/s per Pa).

Formula and method

$$q_o = \frac{2\pi k h(\bar{p} - p_{wf})}{\mu_o B_o \left[\ln\frac{r_e}{r_w} - 0.75 + s\right]}\ (\text{pseudo}-\text{steady}), \quad J = \frac{q_o}{\bar{p} - p_{wf}}$$

Variables

k	Permeability	m²
h	Net pay thickness	m
$\bar{p}$	Reservoir pressure (average or at the drainage boundary)	Pa
p_{wf}	Flowing bottom-hole pressure	Pa
μ_o	Oil viscosity	Pa·s
B_o	Oil formation volume factor	-
r_e	Drainage radius	m
r_w	Wellbore radius	m
s	Skin factor	-
regime	Flow regime	-
q_o	Oil rate (stock tank)	m³/s

J	Productivity index	-

Method and standards

Darcy's law for radial flow in SI units (Ahmed's field form uses 0.00708 kh/(μB) with k in mD, h in ft, p in psi and q in STB/d).

Assumptions and limits

- Single-phase, homogeneous, radial drainage.

References

- Ahmed
- Reservoir Engineering Handbook
- 5th ed. (Gulf Professional Publishing, 2019)
- ch. 6
- eqs. 6-27 and 6-149 (radial flow, skin)

Report details

Report reference	FCC-B01D-AAZ0 (the same inputs always give the same reference)
Generated	17 November 2026, 19:50 UTC
Calculator	Oil Well Rate and Productivity Index (Radial Darcy Flow)
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.

This calculator online

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