Horizontal Well Productivity: Borisov, Giger, Joshi, Renard–Dupuy

Steady-state productivity index and rate of a horizontal oil well by Borisov, Giger–Reiss–Jourdan, Joshi and Renard–Dupuy, with anisotropy and drainage ellipse.

Input parameters

Unit system: SI

Parameter	Value	Unit
Horizontal permeability	20.000	mD
Vertical permeability	4.0000	mD
Net pay thickness	30.000	ft
Horizontal length of the well	1,500.0	ft
Drainage area of the well	80.000	acre
Oil viscosity	2.0000	cP
Oil formation volume factor	1.1500	
Wellbore radius	0.35000	ft
Pressure at the drainage boundary	2,500.0	psi
Flowing bottom-hole pressure	1,800.0	psi

Calculated results

Parameter	Value	Unit
Drainage radius of the horizontal well	1,053.2	ft
Half major axis of the drainage ellipse (Joshi)	1,194.0	ft
Productivity index, Borisov (isotropic)	1.7028	bbl/(d·psi)
Productivity index, Giger–Reiss–Jourdan	1.2184	bbl/(d·psi)
Productivity index, Joshi	1.3044	bbl/(d·psi)
Productivity index, Renard–Dupuy	1.5765	bbl/(d·psi)
Oil rate by Joshi	913.09	bbl/d
Productivity index of a vertical well in the same area	0.23066	bbl/(d·psi)
Gain over the vertical well (Joshi)	5.6551	

Notes for this case

- Steady-state single-phase flow. The rate is taken from Joshi's method; the four methods usually agree within about 20 %.
- Borisov's equation is for an isotropic reservoir and is evaluated with the horizontal permeability; the other three include k_h/k_v.

Formula and method

$$J_J = \frac{2\pi k_h h/(\mu_o B_o)}{\ln R + \frac{\beta^2 h}{L}\ln\frac{h}{2r_w}}, \quad R = \frac{a + \sqrt{a^2 - (L/2)^2}}{L/2}, \quad a = \frac{L}{2}\left[0.5 + \sqrt{0.25 + (2r_{eh}/L)^4}\right]^{1/2}, \quad \beta = \sqrt{k_h/k_v}$$

Variables

k_h	Horizontal permeability	m²
k_v	Vertical permeability	m²
h	Net pay thickness	m
L	Horizontal length of the well	m

A	Drainage area of the well	m²
μ_o	Oil viscosity	Pa·s
B_o	Oil formation volume factor	-
r_w	Wellbore radius	m
p_e	Pressure at the drainage boundary	Pa
p_{wf}	Flowing bottom-hole pressure	Pa
r_{eh}	Drainage radius of the horizontal well	m
a	Half major axis of the drainage ellipse (Joshi)	m
$J_{Borisov}$	Productivity index, Borisov (isotropic)	m³/(s·Pa)
J_{Giger}	Productivity index, Giger–Reiss–Jourdan	m³/(s·Pa)
J_{Joshi}	Productivity index, Joshi	m³/(s·Pa)
J_{RD}	Productivity index, Renard–Dupuy	m³/(s·Pa)
q_{oh}	Oil rate by Joshi	m³/s
J_v	Productivity index of a vertical well in the same area	m³/(s·Pa)
J_h/J_v	Gain over the vertical well (Joshi)	-

Method and standards

Steady-state horizontal-well inflow.

Assumptions and limits

- Steady state; single phase; well centred in the pay.

Report details

Report reference	FCC-MP7T-S535 (the same inputs always give the same reference)
Generated	23 November 2026, 17:26 UTC
Calculator	Horizontal Well Productivity: Borisov, Giger, Joshi, Renard–Dupuy
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 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

https://calc.firecad.com/chemical/reservoir-engineering/horizontal-well-productivity

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.