Linear Darcy Flow of Oil (with Dip) or Gas in Porous Media

Flow rate through a linear porous body from permeability, area, length and pressures: liquid with the gravity potential for a dip, or gas by pressure squared.

Input parameters

Unit system: SI

Parameter	Value	Unit
Fluid	Liquid (slightly compressible)	
Permeability	80.000	mD
Cross-sectional area	5,000.0	ft²
Length	1,500.0	ft
Viscosity	1.5000	cP
Upstream pressure	2,500.0	psi
Downstream pressure	2,480.0	psi
Porosity	18.000	%
Liquid density (liquid)	50.000	lb/ft³
Dip of the flow path, positive upward (liquid)	0	°
Temperature (gas)	150.00	°F
Gas Z at the mean pressure (gas)	0.85000	

Calculated results

Parameter	Value	Unit
Flow rate at reservoir conditions (liquid) or at the mean pressure (gas)	4.0075	bbl/d
Gas rate at standard conditions (gas)	0	Mscf/d
Apparent (Darcy) velocity	5.2085e-08	ft/s
Actual (interstitial) velocity	2.8936e-07	ft/s
Mean pressure (gas)	2,490.0	psi

Notes for this case

• Darcy's law, laminar single-phase flow. For a liquid flowing up-dip part of the pressure difference lifts the fluid; a negative rate means the fluid flows from p_2 to p_1. For gas, take μ and Z at the mean pressure shown.

Formula and method

$$q = \frac{kA[(p_1 - p_2) - \rho g L \sin\alpha]}{\mu L}, \quad Q_{sc} = \frac{kA T_{sc}(p_1^2 - p_2^2)}{2 p_{sc} T Z \mu L}, \quad v = \frac{q}{\phi A}$$

Variables

fluid	Fluid	-
k	Permeability	m²
A	Cross-sectional area	m²
L	Length	m
μ	Viscosity	Pa·s
p_1	Upstream pressure	Pa

p_2	Downstream pressure	Pa
ϕ	Porosity	-
ρ	Liquid density (liquid)	kg/m³
α	Dip of the flow path, positive upward (liquid)	rad
T	Temperature (gas)	K
Z	Gas Z at the mean pressure (gas)	-
q	Flow rate at reservoir conditions (liquid) or at the mean pressure (gas)	m³/s
Q_{sc}	Gas rate at standard conditions (gas)	Nm³/s
u	Apparent (Darcy) velocity	m/s
v	Actual (interstitial) velocity	m/s
$\bar{p}$	Mean pressure (gas)	Pa

Method and standards

Darcy's law, linear geometry.

Assumptions and limits

- Laminar, single-phase, homogeneous medium.

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/reservoir-engineering/linear-darcy-flow-reservoir

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Reopens the calculator with the inputs of this report.