Pore Volume Compressibility and Porosity Change

Formation (pore volume) compressibility by Hall and Newman, the porosity at a new pressure and the change in pore volume for a pressure drop.

Input parameters

Unit system: SI

Parameter	Value	Unit
Original porosity	25.000	%
Pore compressibility to use (0 = Hall's correlation)	0	1/psi
Original pressure	4,200.0	psi
Current pressure	3,000.0	psi
Original pore volume	5,000,000	bbl

Calculated results

Parameter	Value	Unit
Hall's correlation	3.2705e-06	1/psi
Newman, consolidated sandstone	2.0388e-06	1/psi
Porosity at the current pressure	24.902	%
Reduction in pore volume	19,623	bbl

Notes for this case

• Porosity and pore volume use the compressibility you enter, or Hall's value if you enter zero. Laboratory hydrostatic values are about twice the uniaxial (reservoir) compressibility. Pore compressibility matters most in undersaturated oil reservoirs.

Formula and method

$$c_f = \frac{1.782}{\phi^{0.438}} \times 10^{-6}, \quad c_f = \frac{97.32 \times 10^{-6}}{(1 + 55.8721\phi)^{1.42859}} \ (\text{psi}^{-1}), \quad \phi = \phi_o e^{c_f(p - p_o)}, \quad \Delta V_p = c_f V_p \Delta p$$

Variables

ϕ_o	Original porosity	-
c_f	Pore compressibility to use (0 = Hall's correlation)	1/Pa
p_o	Original pressure	Pa
p	Current pressure	Pa
V_p	Original pore volume	m³
$c_{f,Hall}$	Hall's correlation	1/Pa
$c_{f,Newman}$	Newman, consolidated sandstone	1/Pa
ϕ	Porosity at the current pressure	-
ΔV_p	Reduction in pore volume	m³

Method and standards

Pore compressibility correlations.

Assumptions and limits

- Elastic rock; constant compressibility.

Report details

Report reference	FCC-VGGS-J9ZA (the same inputs always give the same reference)
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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/pore-compressibility-porosity

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.