Wellbore Storage Coefficient and End of Storage Effects

Wellbore storage from fluid expansion or a moving liquid level in the annulus, its dimensionless value, and the time when the semilog straight line begins.

Input parameters

Unit system: SI

Parameter	Value	Unit
Wellbore condition	Wellbore full of single-phase fluid (expansion)	
Volume of fluid in the wellbore	90.000	bbl
Compressibility of the wellbore fluid	3.0000e-05	1/psi
Tubing outside diameter	2.8750	in
Casing inside diameter	6.1840	in
Density of the wellbore liquid	50.000	lb/ft³
Permeability	8.0000	mD
Net pay thickness	35.000	ft
Viscosity	1.2000	cP
Skin factor	5.0000	
Porosity	12.000	%
Total compressibility	1.5000e-05	1/psi
Wellbore radius	0.35400	ft

Calculated results

Parameter	Value	Unit
Storage from fluid expansion	0.002700	bbl/psi
Storage from the moving liquid level	0.083865	bbl/psi
Storage coefficient for the condition chosen	0.002700	bbl/psi
Dimensionless storage	305.60	
Time when the semilog straight line begins	3.0086	h

Notes for this case

• A rising or falling liquid level gives a storage coefficient a hundred times that of fluid expansion. Downhole shut-in or a packer close to the perforations shortens the storage period. The end time is the rule t > (200,000 + 12,000 s)C/(kh/μ) in hours (C in bbl/psi, k in mD, h in ft, μ in cP).

Formula and method

$$C_{fe} = V_{wb} c_{wb}, \quad C_{fl} = \frac{A_a}{\rho g}, \quad C_D = \frac{C}{2\pi\phi c_t h r_w^2}, \quad t > \frac{(200{,}000 + 12{,}000 s)C}{kh/\mu} \ \text{(h; field units)}$$

Variables

well	Wellbore condition	-
V_{wb}	Volume of fluid in the wellbore	m³
c_{wb}	Compressibility of the wellbore fluid	1/Pa
OD_t	Tubing outside diameter	m
ID_c	Casing inside diameter	m

ρ	Density of the wellbore liquid	kg/m³
k	Permeability	m²
h	Net pay thickness	m
μ	Viscosity	Pa·s
s	Skin factor	-
ϕ	Porosity	-
c_t	Total compressibility	1/Pa
r_w	Wellbore radius	m
C_{fe}	Storage from fluid expansion	m³/Pa
C_{fl}	Storage from the moving liquid level	m³/Pa
C	Storage coefficient for the condition chosen	m³/Pa
C_D	Dimensionless storage	-
t_{end}	Time when the semilog straight line begins	s

Method and standards

Wellbore storage.

Assumptions and limits

- Constant storage coefficient.

Report details

Report reference	FCC-BCK5-R5N2 (the same inputs always give the same reference)
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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/wellbore-storage-coefficient

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Reopens the calculator with the inputs of this report.