Solution Gas-Oil Ratio and Bo by Vasquez–Beggs

Gas solubility and oil formation volume factor of saturated crude at a pressure by the Vasquez–Beggs correlation, with gas gravity corrected to 100 psig separation.

Method: Ahmed; Reservoir Engineering Handbook; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Pressure (at or below the bubble point)	2,000.0	psi
Temperature	82.222	°C
Oil gravity	35.000	
Gas gravity at the separator (air = 1)	0.75000	
Separator pressure (absolute)	114.70	psi
Separator temperature	15.556	°C

Calculated results

Parameter	Value	Unit
Gas gravity at 100 psig separator	0.75000	
Solution gas-oil ratio	409.70	scf/STB
Oil formation volume factor	1.2558	

Notes for this case

- Valid for saturated oil (pressure at or below the bubble point). Coefficients change at 30 °API. With unknown separator conditions, enter 114.7 psia so that no correction is made.

Formula and method

$$R_s = C_1 \gamma_{gs} p^{C_2} \exp\left(\frac{C_3\,\mathrm{API}}{T}\right), \quad B_o = 1 + C_1{}' R_s + (T-520)\frac{\mathrm{API}}{\gamma_{gs}}(C_2{}' + C_3{}' R_s)$$

$$\gamma_{gs} = \gamma_g \left[1 + 5.912 \times 10^{-5}\,\mathrm{API}\,(T_{sep} - 460)\log\frac{p_{sep}}{114.7}\right]$$

Variables

p	Pressure (at or below the bubble point)	Pa
T	Temperature	K
API	Oil gravity	-
γ_g	Gas gravity at the separator (air = 1)	-
p_{sep}	Separator pressure (absolute)	Pa
T_{sep}	Separator temperature	K
γ_{gs}	Gas gravity at 100 psig separator	-
R_s	Solution gas-oil ratio	m^3/m^3
B_o	Oil formation volume factor	-

Method and standards

Vasquez–Beggs in field units (psia, °R, scf/STB): API ≤ 30: C_1 = 0.0362, C_2 = 1.0937, C_3 = 25.7240, $C_1{}'$ = 4.677×10^{-4}, $C_2{}'$ = 1.751×10^{-5}, $C_3{}'$ = -1.811×10^{-8}; API > 30: 0.0178, 1.1870, 23.931, 4.670×10^{-4}, 1.100×10^{-5}, 1.337×10^{-9}.

Assumptions and limits

- Saturated black oil.

References

- Ahmed
- Reservoir Engineering Handbook
- 5th ed. (Gulf Professional Publishing, 2019)
- ch. 2
- eqs. 2-70
- 2-71 and 2-85 (Vasquez and Beggs, 1980)

Report details

Report reference	FCC-JN89-1GD0 (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/oil-gas/vasquez-beggs-rs-bo

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Reopens the calculator with the inputs of this report.