

Assumptions made for Calculations for Liquid Recoveries



1. Q is averaged at a constant rate.
2. P_f is formation flowing pressure at a constant rate.
3. Formation flow is taken as single phase flow.
If gas is produced at surface, phase separation is assumed to have occurred in drill pipe.
4. Radial flow is assumed.
5. For the purpose of calculating EDR where specific reservoir parameters are not available it is assumed that:

Effective permeability, K, will fall between	1 to 200 md
Formation porosity, ϕ , will fall between	0.1 to 0.3
Fluid compressibility, c, will fall between	10^{-6} to 10^{-4}
Fluid viscosity, μ , will fall between	0.05 to 50 cp.
Well bore radius, r_w , will fall between	3 7/8" to 4 3/8"

Which gives an average value for the function $\log \frac{K}{\phi \mu c r_w^2}$ of 5.5

6. Other standard radial flow, equilibrium assumptions.

Empirical Equations:

1. $EDR = \frac{P_o - P_f}{M(\log T + 2.65)}$ where $M = \frac{P_1 - P_{10}}{\text{Log Cycle}}$

2. Transmissibility $\frac{Kh}{\mu\beta} = \frac{162.6 Q}{M}$

3. DST $J = \frac{Q}{P_o - P_f}$ Theoretical $J = \frac{7.08 \times 10^{-3} Kh}{\mu\beta \ln(r_e/r_w)}$ Assumed $\ln(r_e/r_w) = 7.60$

4. P.S. = $\left[P_o \times 2.309 \text{ ft./PSI} \right] - \left[\text{Recorder depth to sea level.} \right]$

5. Radius of investigation, $r_i \cong \sqrt{\frac{Kt}{40\phi\mu c}}$ where t = time in days

Symbols	Dimensions	Symbols	Dimensions
β	Formation volume factor vol./vol.	Q_o	Rate of oil flow during test Bbls./day
c	Fluid compressibility vol./vol./psi	Q_w	Rate of water flow during test Bbls./day
EDR	Estimated damage ratio	Q_g	Rate of gas flow during test MCF/day
ϕ	Formation porosity fractional	r_e	External Boundary Radius feet
h	Net producing interval feet	r_i	Radius of investigation feet
J	Productivity index (P.I.) Bbls./day/PSI	r_w	Well bore radius inches
K	Permeability Millidarcies	S_w	Water saturation %
M	Slope of shut-in build up PSI/log cycle	t	Shut-in time period minutes
P_f	Final flowing pressure PSIG	Δt	Increment time of shut-in period minutes
$P_{f_{si}}$	Final shut-in pressure at time t PSIG	T	Open flow time period minutes
$P_{i_{si}}$	Initial shut-in pressure PSIG	$^{\circ}T_f$	Formation temperature $^{\circ}$ Rankin
P_o	Maximum reservoir pressure PSIG	μ	Fluid viscosity (Reservoir Conditions) Centipoise
P_1	Final shut-in build up plot intercept @ 1 PSIG	Z	Gas deviation factor (compressibility factor)
P_{10}	Final shut-in build up plot intercept @ 10 PSIG	$\frac{Kh}{\mu\beta}$ or $\frac{Kh}{\mu}$	Transmissibility factor $\frac{\text{Md.} - \text{ft.}}{\text{Cp.}}$
P.S.	Potentiometric surface feet		
Q	Rate of flow during test Bbls./day		

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