

**Abbreviations**

Abbreviation	Term
cm	centimetres
ID	inside diameter
kg	kilogram
kPa	kilopascal
kPa/m	kilopascal per metre
m	metres
m ³	cubic metre
m ³ /m	cubic metres per metre
m ³ /min	cubic metres per minute
MD	measured depth
mm	millimetres
kg/m ³	kilogram per cubic metre
OD	outside diameter
P	pressure
SICHP	shut-in casing head pressure
SITHP	shut-in tubing head pressure
TVD	true vertical depth
V	volume

Constant factors	
Constant factor pressure	0.00981
Constant factor capacity (using mm)	0.0000007854
Constant factor capacity (using inches)	1973.5

Formulas**1. Pressure gradient (kPa/m)**

$$\text{fluid density (kg/m}^3\text{)} \times 0.00981$$

2. Fluid density (kg/m³)

$$\text{hydrostatic pressure (kPa)} \div \text{TVD (m)} \div 0.00981$$

or

$$\frac{\text{hydrostatic pressure (kPa)}}{\text{TVD(m)} \times 0.00981}$$

3. Hydrostatic pressure (kPa)

$$\text{fluid density (kg/m}^3\text{)} \times 0.00981 \times \text{TVD (m)} \quad \text{or} \quad \text{pressure gradient (kPa/m)} \times \text{TVD (m)}$$

4. Formation pressure (kPa)

$$\text{SITHP (kPa)} + \text{hydrostatic column pressure to the top perforation (kPa)}$$

**5. Kill weight gradient (kPa/m)**

$$\frac{(\text{well fluid gradient (kPa/m)} \times \text{TVD to point of circulation (m)}) + \text{SITHP (kPa)} + \text{overbalance* (kPa)}}{\text{TVD to point of circulation (m)}}$$

*overbalance is variable and will be stated

6. Tubing capacity (m³/m)

$$\text{tubing ID}^2 \text{ (mm)} \times 0.0000007854 \quad \text{or} \quad \frac{\text{tubing ID}^2 \text{ (inches)}}{1973.5}$$

7. Annulus capacity (m³/m)

$$(\text{casing ID}^2 \text{ (mm)} - \text{tubing OD}^2 \text{ (mm)}) \times 0.0000007854$$

or

$$\frac{\text{casing ID}^2 \text{ (inches)} - \text{tubing OD}^2 \text{ (inches)}}{1973.5}$$

8. Volume (m³)

$$\text{capacity (m}^3\text{/m)} \times \text{MD (m)}$$

9. Time to pump/displace (minutes)

$$\frac{\text{capacity (m}^3\text{/m)} \times \text{MD (m)}}{\text{pump rate (m}^3\text{/min)}} \quad \text{or} \quad \frac{\text{volume (m}^3\text{)}}{\text{pump rate (m}^3\text{/min)}}$$

10. Area of a circle (cm²)

$$0.785 \times \text{diameter}^2 \text{ (cm)}$$

11. Force (kg force)

$$\text{area (cm}^2\text{)} \times (\text{applied pressure (kPa)} \div 98.0665)$$

12. New pump/circulating pressure (kPa)

$$\text{pump pressure (kPa)} \times \left(\frac{\text{new pump rate (m}^3\text{/min)}}{\text{old pump rate (m}^3\text{/min)}} \right)^2$$

13. Basic gas law

$$P_1 \times V_1 = P_2 \times V_2$$

$$P_2 = \frac{P_1 \times V_1}{V_2}$$

$$V_2 = \frac{P_1 \times V_1}{P_2}$$