Abbreviations

Abbreviation	Term
bar	bar (pressure)
bar/m	bar per metre
ID	inside diameter
in	inches
kg	kilogram
kg/l	kilogram per litre
l	litres
l/m	litres per metre
l/min	litres per minute
m	metres
MD	measured depth
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	0.0981
Constant factor capacity (using inches)	1.9735

Formulas

1. **Pressure gradient (bar/m)**

   fluid density (kg/l) × 0.0981

2. **Fluid density (kg/l)**

   hydrostatic pressure (bar) ÷ TVD (m) ÷ 0.0981

   or

   $$\frac{\text{hydrostatic pressure (bar)}}{\text{TVD (m)} \times 0.0981}$$

3. **Hydrostatic pressure (bar)**

   fluid density (kg/l) × 0.0981 × TVD (m) **or** pressure gradient (bar/m) × TVD (m)

4. **Formation pressure (bar)**

   SITHP (bar) + hydrostatic column pressure to the top perforation (bar)

5. Kill weight gradient (bar/m)

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

*Overbalance (at the point of circulation) is variable and will be stated

6. Tubing capacity (l/m)

$$\frac{\text{tubing ID}^2\text{ (in)}}{1.9735}$$

7. Annulus capacity (l/m)

$$\frac{\text{casing ID}^2\text{ (in)} - \text{tubing OD}^2\text{ (in)}}{1.9735}$$

8. Volume (l)

capacity (l/m) × MD (m)

9. Time to pump/displace (minutes)

$$\frac{\text{capacity (l/m)} \times \text{MD (m)}}{\text{pump rate (l/min)}}$$

or

$$\frac{\text{volume (l)}}{\text{pump rate (l/min)}}$$

10. Area of a circle (in²)

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

11. Force (kg force)

$6.58 \times \text{area (in}^2) \times \text{applied pressure (bar)}$

12. New pump/circulating pressure (bar)

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

13. Basic gas law

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

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