MISCELLANEOUS DRILLING CALCULATIONS

Hole Volume

ID in Inches (litres per metre) = $\frac{(I.D)^2}{1273}$

Example for a 4-inch hole:

4 x 4 = 16 ÷ 2 = 8 litres per metre

Annular Volume (ID in millimetres)

(Litres per metre) = $\frac{(I.D\ hole)^2 - (O.D\ pipe)^2}{1273}$

Example for a 120mm hole and 80mm pipe

$120^2(14,400) - 80^2(6,400) = 8,000 \div 1273 = 6.2$ litres per metre

ID in millimetres (litres per metre) = $\frac{(I.D)^2}{1273}$

Example for a 120mm hole:

120 x 120 = 14,400 ÷ 1273 = 11.31 litres per metre

Annular Velocity

(Metres per minute) = $\frac{Pump\ Rate \times 1273}{(I.D\ hole)^2 - (O.D\ pipe)^2}$

Example for a 100mm hole with 50mm pipe pumping 150 litres per minute:

150 pump rate x 1273 = $\frac{190,950}{100^2(10,000) - 50^2\ (2,500)\quad 7,500}$ = 25.46 metres per minute

Total Circulation Time

(minutes) = $\frac{\textbf{T}otal\ hole\ \textbf{V}olume}{\textbf{P}ump\ \textbf{R}ate}$

Example for **TV** 5,000 litres with a **PR** of 100 litres per minute

5,000 ÷ 100 = 50 minutes

Total Circulation time is the time required for the drilling fluid to be pumped from the rig tank into the drill string, exit the drill bit, travel up the annulus then exit the hole.

Bottoms Up Time

(minutes) = $\frac{\textbf{A}nnular\ \textbf{V}olume}{\textbf{P}ump\ \textbf{R}ate}$

Example for an **AV** of 2,000 litres with a **PR** of 50 litres per minute:

2,000 ÷ 50 = 40 minutes

Bottoms up time is the time taken for the fluid to exit the drill bit, travel up the annulus and exit the hole.

Pressure Conversions

To convert **S**pecific **G**ravity (**S.G**) to Pounds Per Gallon (**ppg**)

Mud weight in **ppg** x 8.33 = **S.G**

1 bar = 14.51 psi

1 psi = 6.89 kpa

Weight up with Barite

Kg of Barite/m^3 of Fluid =

$$\frac{4200 \times (Sg2 - Sg1)}{(4.2 - Sg2)}$$

Sg1. Starting Weight

Sg2. Desired Weight

Example: The Amount of Barite required to take a Mud Weight from 1.1 to 1.3 is 4200 x (1.3 - 1.1) ÷ (4.2 - 1.3) = 289 kg per 1000 litres

Solid content by %

Solids Content from mud weight (% by vol.) = Mud weight in SG

$$\frac{(MudWeight - 1)}{1.7} \times 100$$

Example: Mud Weight 1.13 - 1 ÷ 1.7 x 100 = 7.6 % Soilds

Hydrostatic Pressure in bar

SG Specific Gravity

TVD True vertical depth

Hydrostatic Pressure = $\frac{\textbf{SG x TVD}}{\textbf{10.2 [bar]}}$

Example: Mud Weight 1.17 x 350 metre hole ÷ 10.2 = 40.14 bar