**Well control calculations**

Hydrostatic Pressure = Fluid Density × 0.052 × Depth TVD

Pressure Gradient = Fluid Density (ppg) × 0.052

**Psi/ft= 0.052**

**(I) Gain In Pits (bbls) = (Slug Weightppg – Annulus Weightppg) × Volume of Slugbbls ÷ Annulus Weightppg**

**(II) Distance of Drop ft = Gain In Pitbls ÷ Pipe Capacitybbls/ft**

**(III) EMW(equivalent mud density) = (Pressure ÷ 0.052 ÷ Depth of InterestTVD) + Present Fluid Density**

(IV)To calculate the volume to fill the well when tripping dry pipe out:

**Barrels to Fill = Pipe Displacementbbls/ft × Length Pulledft**

(V)To calculate the volume to fill the well when tripping wet pipe out:

**Barrels to Fill = (Pipe Displacementbbls/ft + Pipe Capacitybbls/ft) × Length Pulledft**

**(VI)Strokes to Fill = Barrels to Fill ÷ Pump Outputbbls/stk**

**(VII) For dry pipe max length can be tripped by pressure drop**

**Max. Lengthft = (Pressure Droppsi ÷ 0.052 ÷ Fluid Densityppg) × (Csg. Cap.bbls/ft**

**– Pipe Displ.bbl/ft) ÷ Pipe Displ.bbl/ft**

**(VIII)For wet pipe max length can be tripped by pressure drop**

**Max. Lengthft = (Pressure Droppsi ÷ 0.052 ÷ Fluid Densityppg) × (Csg. Cap.bbls/ft**

**– Pipe Displ.bbl/ft – Pipe Cap.bbl/ft) ÷ (Pipe Displ.bbl/ft + Pipe Cap.bbl/ft)**

**(IX) Trip Marginppg = (Margin Neededpsi – Present Marginpsi) ÷ 0.052 ÷ Depthft, TVD**

**(X) Estimated Kick Lengthft = Pit Gainbbls ÷ Annular Capacitybbls/ft**

**(XI) Kickppg = MWppg – ([SICPpsi – SIDPPpsi] ÷ [Kick Lengthft × 0.052])**

**(XII) Circulating Pressure** (psi): (MW x TVD x 0.0519) + Pla

where: Pla = Annular Pressure Loss (psi)

**(XIII) Initial Circulating Pressure** (psi): SPR + SIDP

where: SPR = System pressure loss at kill rate (psi)

SIDP= Shut-in Drillpipe Pressure (psi)

**(XIV) Final Circulating Pressure** (psi): (KMW / MW) x SPR

where: KMW = Kill Mud Density (lb/gal)

**(XV) Kill Mud Weight** (lb/gal): MW + (SIDP / (TVD x 0.0519))

**(XVI) Formation pressure with SIDP**

**Formation Pressure** (psi): SIDP + (MW x TVD x 0.0519)

**(XVII) Density of influx** (ppg): MW - [(SICP - SIDP)/(L x 0.0519)]

where: SICP= Shut in casing pressure (psi)

L = Length of influx (ft)

**(XVIII) Length of kick around drill collars** (ft):

Pit Gain (bbls)/ Annular Volume around collars (bbls/ft)

**(XIX) Length of kick, drill collars and drill pipe** (ft):

Collar Length + [(Pit Gain - Collar Annular Volume) / (D12 - D22 x 0.000971)]

where: D1 = hole diameter (inches)

D2 = drillpipe diameter (inches)

**(XX) Gas bubble migration rate** (psi/hr): Pa / (0.0519 x MW)

where: Pa = pressure change over time interval / time interval (hr)

**(XXI) Barite required** (sk/100 bbls mud):

1490 x (KMW - MW) / (35.8 - KMW)

**(XXII) Volume increase caused by weighting up**:

100 x (KMW - MW) / (35.8 - KMW)

**(XXIII) Capacitybbls/ft = ID² ÷ 1029.4**

**(XXIV) Volumebbls = Capacitybbls/ft × Lengthft**

**(XXV) Strokes from pump to Bit/EOT = String Volumebbls ÷ Pump Outputbbls/stk**

**(XXVI) Time = Strokes ÷ Pump ratestks/min**

**(XXvii) Pump Ratebbls/min = Pump Speedstkump Outputbbls/stk**

**(XXVIII) Timemin = Volume to Pumpbbls ÷ Rate per Minutestks/min**

**(XXiX) Annular Capacitybbls/ft = (OD² – ID²) ÷ 1029.4**

**(XXX)Total Annular Volume = A + B + C**

A. bbls (m³) between drillpipe and casing

B. bbls (m³) between drillpipe and open hole

C. bbls (m³) between drill collars and open hole

1. **Strokes Bit to Surfacestks = Annular Volumebbls ÷ Pump Outputbbls/stk**
2. **Time required to displace the annulus=Annular Volumebbls ÷ Rate per Minutebbls/min**
3. **Pump rate in bbls/min=** **stks/min × Pump Output**
4. **SIDPP = Formation Pressure – Hydrostatic Pressure of Mud in Drillstring**
5. **SICP = Formation Pressure – Hydrostatic Pressure of Mud in Annulus – Hydrostatic Pressure of Influx**
6. **Adjusted Casing Internal Yield = Casing Internal Yield × Safety Factor**
7. **Adjusted Tubing Internal Yield = Tubing Yield × Safety Factor**
8. **Adjusted Tubing Collapse = Tubing Collapse × Safety Factor**
9. **Average Hydrostatic Pressure in Tubing = Formation Pressure – Initial Shut in Pressure**
10. **Initial Estimated Maximum Pressure on Tubing = Estimated Formation Integrity Pressure (Fracture Pressure) – Average Hydrostatic Pressure in Tubing**
11. **Final Estimated Max Pressure On Tubing = Estimated Formation Integrity Pressure (Fracture Pressure) – Kill Fluid Hydrostatic**

**For accumulators**

Total volume required to open or close an accumulator= usable volume/ (2/3)

Number of accumulators= total volume/capacity of each accumulator

**During killing**

1. New circulation pressure Pc2= (kill mud weight x Pc1) / initial mud weight
2. MASICP = (maximum allowable — mud wt. in use, ppg) x 0.052 x (casing shoe TVD, ft)

**Kick Tolerance Factor (KTF)**

1. KTF = (Casing shoe TVD, ft) x (maximum allowable mud wt, ppg — mud wt in use, ppg)

Well depth

1. Maximum surface pressure = kick tolerance factor, ppg x 0.052 x TYD, ft
2. Maximum FP, psi = (kick tolerance factor, ppg + mud wt in use, ppg) x 0.052 x TYD, ft