IADC WellCAP Well Control Worksheet
Bullhead

Well Name: _____ **Completed By:** _____ **Date:** ____ /____ /____

PRE-RECORDED INFORMATION

TRUE PUMP OUTPUT: _____ (m³/Stk @ 100%) x _____ (% Efficiency) = _____ (TPO (m³/Stk))

PUMP RATE CONSIDERATIONS:
Kill Rate Speeds and Volume

_____ (Desired Barrels per Minute (m³/MIN)) ÷ _____ (Pump Output (m³/STK)) = _____ (Pump Rate (STKS/MIN))

_____ (Desired Barrels per Minute (m³/MIN)) ÷ _____ (Pump Output (m³/STK)) = _____ (Pump Rate (STKS/MIN))

_____ (Desired Barrels per Minute (m³/MIN)) ÷ _____ (Pump Output (m³/STK)) = _____ (Pump Rate (STKS/MIN))

VOLUME AND STROKE CONSIDERATIONS:
Tubing Volume/Strokes (Surface to End of Tubing, E.O.T.)

_____ (Tubing Length Surface to E.O.T. (MD — m)) x _____ (Capacity per Foot in Tubing (m³/m)) = _____ (Tubing Volume Surface to E.O.T. (m³)) ÷ _____ (Pump Output (m³/STK)) = _____ (Strokes Surface to E.O.T. (STKS))

Casing Volumes/Strokes (Below End of Tubing, E.O.T. to Perforations)

_____ (Length E.O.T. to Perfs Top/Middle/Bottom (MD — m)) x _____ (Capacity per Foot in Casing (m³/m)) = _____ (Casing Volume E.O.T. to Perforations (m³)) ÷ _____ (Pump Output (m³/STK)) = _____ (Strokes E.O.T. to Perforations (STKS))

Surface to Perforations Volume/Strokes (Kill Point)

_____ (Tubing Volume Surface to E.O.T. (m³)) + _____ (Casing Volume E.O.T. to Perforations (m³)) = _____ (Surface to Perforations Volume (m³)) ÷ _____ (Pump Output (m³/STK)) = _____ (Strokes Surface to Perforations (Kill Point — STKS))

Total Volume/Stokes to Pump (Including Overdisplacing)

_____ (Surface to Perforations Volume (m³)) + _____ (Overdisplacement — if any — (m³)) = _____ (Total Volume to Pump (m³)) ÷ _____ (Pump Output (m³/STK)) = _____ (Total Strokes to Pump (Overdisplace — STKS))

FORMATION PRESSURE CONSIDERATIONS:
Kill Fluid Density

_____ (Formation Pressure (kPa)) ÷ 0.00981 ÷ _____ (Depth to Perforations Top/Middle/Bottom (TVD — m)) = _____ (Kill Fluid Density (kg/m³))

Estimated Formation Integrity Pressure (Fracture)

_____ (Max. Allowable Mud Density (kg/m³)) x 0.00981 _____ (Depth to Perforations Top/Middle/Bottom (TVD — m)) = _____ (Estimated Formation Integrity Pressure (kPa))

Average Hydrostatic Pressure in Tubing

_____ (Formation Pressure (kPa)) – _____ (Initial Shut in Tubing Pressure (kPa)) = _____ (Average Hydrostatic Pressure in Tubing (kPa))

Initial Estimated Maximum Pressure on Tubing (Static)

_____ (Est. Formation Integrity Pressure (kPa)) – _____ (Average Hydrostatic Pressure in Tubing (kPa)) = _____ (Initial Estimated Max. Pressure on Tubing (kPa))

Kill Fluid Hydrostatic Pressure

_____ (Kill Fluid Density (kg/m³)) x 0.00981 x _____ (Depth to Perforations Top/Middle/Bottom (TVD — m)) = _____ (Kill Fluid Hydrostatic Pressure (kPa))

SLOW CIRCULATION RATE (SCR):

	STKS/MIN	Pressure(kPa)	m³/MIN	Pressure(kPa)
Pump #1				
Pump #2				
Pump #3				

RECORDED WELL DATA:

Formation Pressure _____ kPa

Max. Allowable Mud Density _____ kg/m³

Maximum Pump Pressure _____ kPa

Shut In Tubing Pressure _____ kPa

Shut In Casing Pressure _____ kPa

Tree/Wellhead/
BOP Stack Rating _____ kPa

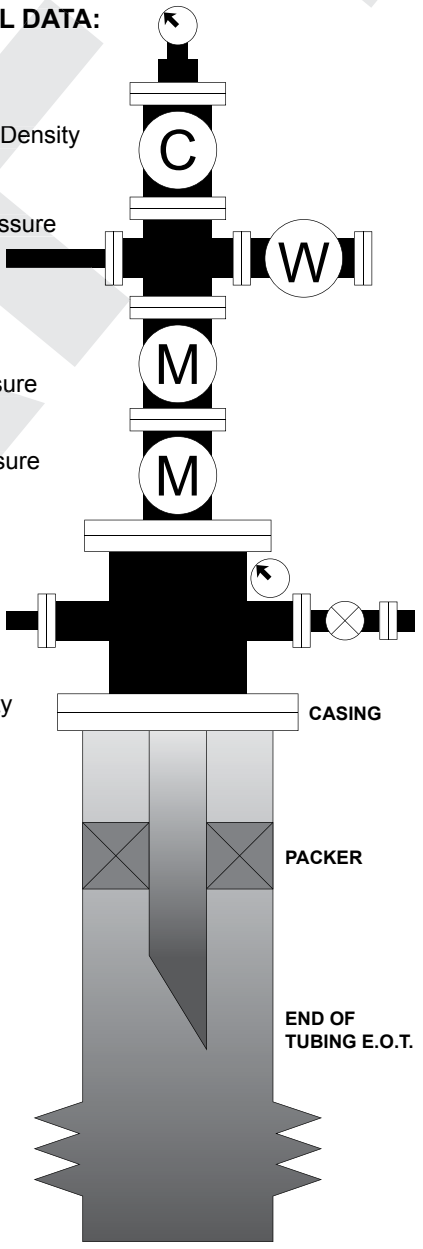
Annulus Fluid Density _____ kg/m³

Packer Set _____ TVD / _____ MD meters

Top Perforation _____ TVD / _____ MD meters

Middle Perforation _____ TVD / _____ MD meters

Bottom Perforation _____ TVD / _____ MD meters



Final Estimated Maximum Pressure on Tubing (Static)

_____ (Est. Formation Integrity Pressure (kPa)) – _____ (Kill Fluid Hydrostatic Pressure (kPa)) = _____ (Final Estimated Max. Pressure on Tubing (kPa))

SI Units
(kPa, m³, kg/m³)

TUBING & CASING DATA

TUBING DATA:

Tubing

Outside Diameter (mm)	Inside Diameter (mm)	Capacity per Foot (m^3/FT)	Length to E.O.T. (MD — m)

Weight (kg/m)	Grade	Internal Yield (kPa @ 100%)	Collapse (kPa @ 100%)

Tubing Collapse

Tubing Collapse (kPa)	x	Safety Factor (0.70 or Less)	=	Adjusted Tubing Collapse (kPa)
	x		=	

Tubing Yield

Tubing Yield (kPa)	x	Safety Factor (0.70 or Less)	=	Adjusted Tubing Internal Yield (kPa)
	x		=	

CASING DATA:

Casing

Outside Diameter (mm)	Inside Diameter (mm)	Capacity per Foot (m^3/FT)	Length (MD — m)

Weight (kg/m)	Grade	Internal Yield (kPa @ 100%)	**TREE/BOP** Rated Pressure (kPa)

Casing Internal Yield

Casing Internal Yield (kPa)	x	Safety Factor (0.70 or Less)	=	Adjusted Casing Yield (kPa)
	x		=	

PRESSURE CONSIDERATIONS:

Pressure Consideration kPa per "Step"

Initial Max. Pressure on Tubing (kPa) (A)	−	Final Max. Pressure on Tubing (kPa) (B)	÷ 10 =	Number of "Steps"	PSI per "Step" (kPa/STEP)
	−		÷ 10 =		

(A) Lesser value of "Tubing Yield" or "Initial Estimated Maximum Pressure on Tubing" results *(see page 1)*

(B) Lesser value of "Tubing Yield" or "Final Estimated Maximum Pressure on Tubing (Static)" results *(see page 1)*

Volume per "Step"

Surface to Perforations Volume (m^3)	÷ 10 =	Number of "Steps"	Volume per "Step" (m^3/STEP)	x 42 =	Volume per "Step" (GALS/STEP)
	÷ 10 =			x 42 =	

Strokes per "Step"

Stroke Surface to Perforations (STKS)	÷ 10 =	Number of "Steps"	Strokes per "Step" (STKS/STEP)
	÷ 10 =		

PRESSURE CHART

Strokes	Volume in m^3	Volume in GALS	Estimated Max. Static Pressure	Actual Tubing Pressure	Casing Pressure	Pump Rate	Notes
0	0	0	Intial				
Kill Point	Final ↓						
Overdisplace ↓							

FORMULAS

1. Pressure Gradient (kPa/m) = Mud Weight (kg/m^3) x 0.00981

2. Hydrostatic Pressure (kPa) = Mud Weight (kg/m^3) x 0.00981 x Depth (m, TVD)

3. Capacity (m^3/m) = Inside Diameter^2 (mm) ÷ 1273

4. Annular Capacity (m^3/m) = (Inside Diameter of Casing^2 (mm) or Hole Diameter^2 (mm) - Outside Diameter of Pipe^2 (mm)) ÷ 1273

5. Pipe Displacement (m^3/m) = (Outside Diameter of pipe^2 (mm) - Inside Diameter of pipe^2 (mm)) ÷ 1273

6. Maximum Allowable Mud Weight (kg/m^3) = $\frac{\text{Surface LOT Pressure (kPa)}}{\text{Shoe Depth (m, TVD) x 0.00981}}$ + LOT Mud Weight (kg/m^3)

7. MAASP (kPa) = [Maximum Allowable Mud Weight (kg/m^3) - Present Mud Weight (kg/m^3)] x 0.00981 x Shoe TVD (m)

8. Formation Pressure (kPa) = Hydrostatic Pressure Mud in Hole (kPa) + SIDPP (kPa)

9. Kg of Barite Needed to Weight-Up Mud = $\frac{m^3 \text{ of Mud in System x 4250 x (KMW - OMW)}}{\text{(4250 - KMW)}}$

NOTE: This formula assumes that the average density of Barite is 35.4 kg/m^3 and the average number of kg per barrel is 4250.

10. Volume Increase from Adding Barite (m^3) = Number of kg added ÷ 4250

11. Equivalent Mud Weight (kg/m^3) @ _____ depth (m) = $\frac{\text{Pressure (kPa)}}{\text{Depth (m, TVD) x 0.00981}}$

12. Estimated New Pump Pressure at New Pump Rate (kPa) = Old Pump Pressure (kPa) x $\left[\frac{\text{New Pump Rate (SPM)}}{\text{Old Pump Rate (SPM)}}\right]^2$

13. Estimated New Pump Pressure with New Mud Weight (kPa) = Old Pump Pressure (kPa) x $\frac{\text{New Mud Weight } (kg/m^3)}{\text{Old Mud Weight } (kg/m^3)}$

COMMENTS