IADC WellCAP Well Control Worksheet
Bullhead

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

PRE-RECORDED INFORMATION

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

PUMP RATE CONSIDERATIONS:
Kill Rate Speeds and Volume

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

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_____ (Desired Barrels per Minute (Liters/MIN)) ÷ _____ (Pump Output (Liters/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 (Liters/m)) = _____ (Tubing Volume Surface to E.O.T. (Liters)) ÷ _____ (Pump Output (Liters/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 (Liters/m)) = _____ (Casing Volume E.O.T. to Perforations (Liters)) ÷ _____ (Pump Output (Liters/STK)) = _____ (Strokes E.O.T. to Perforations (STKS))

Surface to Perforations Volume/Strokes (Kill Point)

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

Total Volume/Stokes to Pump (Including Overdisplacing)

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

FORMATION PRESSURE CONSIDERATIONS:
Kill Fluid Density

_____ (Formation Pressure (bar)) ÷ 10.2 ÷ _____ (Depth to Perforations Top/Middle/Bottom (TVD — m)) = _____ (Kill Fluid Density (kg/l))

Estimated Formation Integrity Pressure (Fracture)

_____ (Max. Allowable Mud Density (kg/l)) x 10.2 x _____ (Depth to Perforations Top/Middle/Bottom (TVD — m)) = _____ (Estimated Formation Integrity Pressure (bar))

Average Hydrostatic Pressure in Tubing

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

Initial Estimated Maximum Pressure on Tubing (Static)

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

Kill Fluid Hydrostatic Pressure

_____ (Kill Fluid Density (kg/l)) x 10.2 x _____ (Depth to Perforations Top/Middle/Bottom (TVD — m)) = _____ (Kill Fluid Hydrostatic Pressure (bar))

SLOW CIRCULATION RATE (SCR):

	STKS/MIN	Pressure(bar)	Liters/MIN	Pressure(bar)
Pump #1				
Pump #2				
Pump #3				

RECORDED WELL DATA:

Formation Pressure _____ bar

Max. Allowable Mud Density _____ kg/l

Maximum Pump Pressure _____ bar

Shut In Tubing Pressure _____ bar

Shut In Casing Pressure _____ bar

Tree/Wellhead/
BOP Stack Rating _____ bar

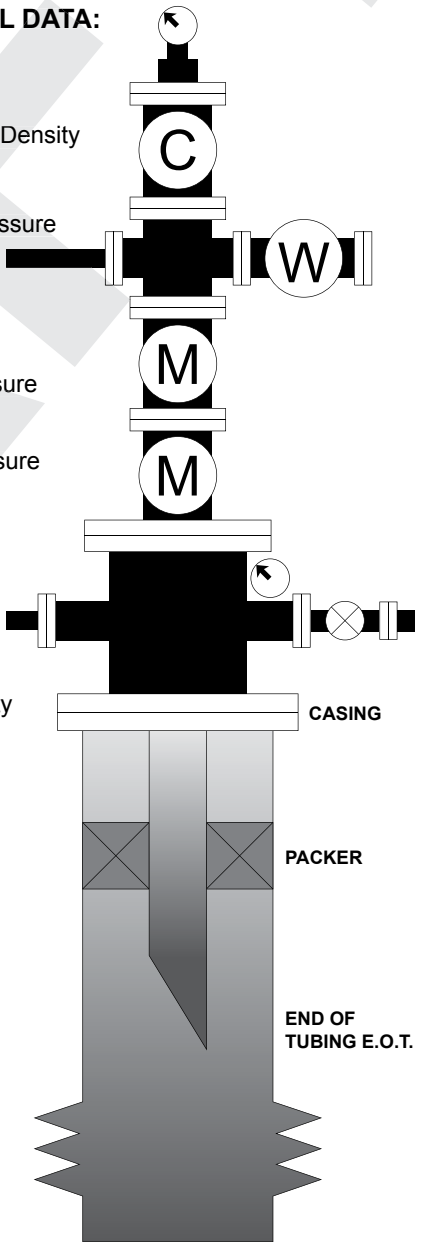
Annulus Fluid Density _____ kg/l

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 (bar)) – _____ (Kill Fluid Hydrostatic Pressure (bar)) = _____ (Final Estimated Max. Pressure on Tubing (bar))

Metric Units
(bar, liter, kg/l)

TUBING & CASING DATA

TUBING DATA:

Tubing

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

Tubing Collapse

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

Tubing

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

Tubing Yield

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

CASING DATA:

Casing

Outside Diameter (mm)	Inside Diameter (mm)	Capacity per Foot (Liters/m)	Length (MD — m)

Casing Internal Yield

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

Casing

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

PRESSURE CONSIDERATIONS:

Pressure Consideration Bars per "Step"

Initial Max. Pressure on Tubing (bar) (A)	–	Final Max. Pressure on Tubing (bar) (B)	÷ 10 =	Number of "Steps"	PSI per "Step" (bar/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 (Liters)	÷ 10 =	Number of "Steps"	Volume per "Step" (Liters/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 Liters	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 (bar/m) = Mud Weight (kg/l) x 10.2

2. Hydrostatic Pressure (bar) = Mud Weight (kg/l) x 10.2 x Depth (m, TVD)

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

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

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

6. Maximum Allowable Mud Weight (kg/l) = $\frac{\text{Surface LOT Pressure (bar)}}{\text{Shoe Depth (m, TVD) x 10.2}}$ + LOT Mud Weight (kg/l)

7. MAASP (bar) = [Maximum Allowable Mud Weight (kg/l) - Present Mud Weight (kg/l)] x 10.2 x Shoe TVD (m)

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

9. Kg of Barite Needed to Weight-Up Mud = $\frac{\text{Liters of Mud in System x 4.25 x (KMW - OMW)}}{\text{(35.4 - KMW)}}$

NOTE: This formula assumes that the average density of Barite is 35.4 kg/l and the average number of kg per barrel is 4.25.

10. Volume Increase from Adding Barite (liters) = Number of Sacks (kg) added ÷ 4.25

11. Equivalent Mud Weight (kg/l) @ _____ depth (m) = $\frac{\text{Pressure (bar)}}{\text{Depth (m, TVD) x 10.2}}$

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

13. Estimated New Pump Pressure with New Mud Weight (bar) = Old Pump Pressure (bar) x $\frac{\text{New Mud Weight (kg/l)}}{\text{Old Mud Weight (kg/l)}}$

COMMENTS