IADC WellCAP Well Control Worksheet
Bullhead

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

TRUE PUMP OUTPUT:

_____ (Bbls/Stk @ 100%) x _____ (% Efficiency) = _____ (TPO (Bbls/Stk))

PUMP RATE CONSIDERATIONS:

Kill Rate Speeds and Volume

Desired Barrels per Minute (BBLS/MIN)	÷	Pump Output (BBLS/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 — FT)	x	Capacity per Foot in Tubing (BBLS/FT)	=	Tubing Volume Surface to E.O.T. (BBLS)	÷	Pump Output (BBLS/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 — FT)	x	Capacity per Foot in Casing (BBLS/FT)	=	Casing Volume E.O.T. to Perforations (BBLS)	÷	Pump Output (BBLS/STK)	=	Strokes E.O.T. to Perforations (STKS)

Surface to Perforations Volume/Strokes (Kill Point)

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

Total Volume/Stokes to Pump (Including Overdisplacing)

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

FORMATION PRESSURE CONSIDERATIONS:

Kill Fluid Density

Formation Pressure (PSI)	÷ 0.052 ÷	Depth to Perforations Top/Middle/Bottom (TVD — FT)	=	Kill Fluid Density (PPG)

Estimated Formation Integrity Pressure (Fracture)

Max. Allowable Mud Density (PPG)	x 0.052 x	Depth to Perforations Top/Middle/Bottom (TVD — FT)	=	Estimated Formation Integrity Pressure (PSI)

Average Hydrostatic Pressure in Tubing

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

Initial Estimated Maximum Pressure on Tubing (Static)

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

Kill Fluid Hydrostatic Pressure

Kill Fluid Density (PPG)	x 0.052 x	Depth to Perforations Top/Middle/Bottom (TVD — FT)	=	Kill Fluid Hydrostatic Pressure (PSI)

SLOW CIRCULATION RATE (SCR):

	STKS/MIN	Pressure(PSI)	BBL/MIN	Pressure(psi)
Pump #1				
Pump #2				
Pump #3				

RECORDED WELL DATA:

Formation Pressure _____ PSI

Max. Allowable Mud Density _____ PPG

Maximum Pump Pressure _____ PSI

Shut In Tubing Pressure _____ PSI

Shut In Casing Pressure _____ PSI

Tree/Wellhead/
BOP Stack Rating _____ PSI

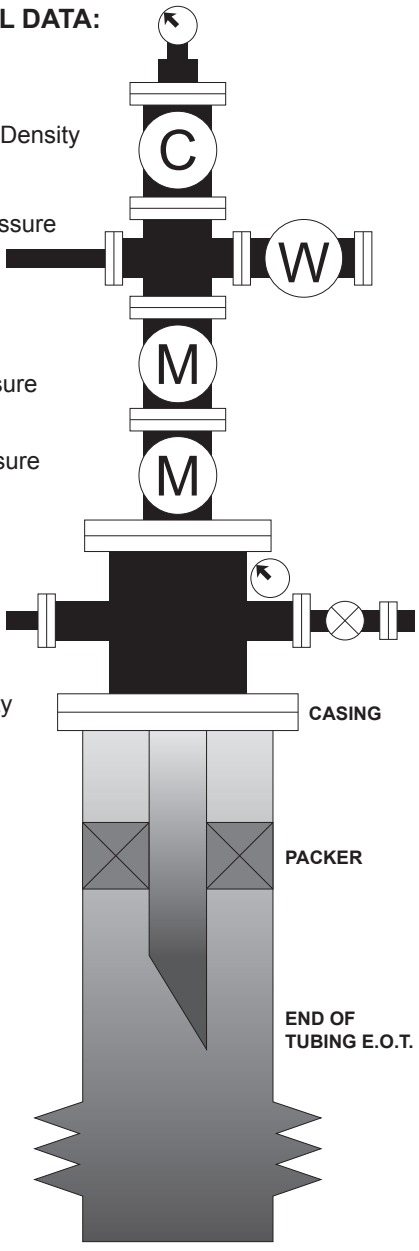
Annulus Fluid Density _____ PPG

Packer Set _____ TVD _____ MD FT

Top Perforation _____ TVD _____ MD FT

Middle Perforation _____ TVD _____ MD FT

Bottom Perforation _____ TVD _____ MD FT



Final Estimated Maximum Pressure on Tubing (Static)

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

TUBING & CASING DATA

TUBING DATA:

Tubing

Outside Diameter (INCHES)	Inside Diameter (INCHES)	Capacity per Foot (BBLS/FT)	Length to E.O.T. (MD — FT)

Tubing Collapse

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

Tubing

Weight (LBS/FT)	Grade	Internal Yield (PSI @ 100%)	Collapse (PSI @ 100%)

Tubing Yield

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

CASING DATA:

Casing

Outside Diameter (INCHES)	Inside Diameter (INCHES)	Capacity per Foot (BBLS/FT)	Length (MD — FT)

Casing Internal Yield

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

Casing

Weight (LBS/FT)	Grade	Internal Yield (PSI @ 100%)	**TREE/BOP** Rated Pressure (PSI)

PRESSURE CONSIDERATIONS:

Pressure Consideration PSI per "Step"

Initial Max. Pressure on Tubing (PSI) (A)	–	Final Max. Pressure on Tubing (PSI) (B)	÷ 10 =	Number of "Steps"	PSI per "Step" (PSI/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 (BBLS)	÷ 10 =	Number of "Steps"	Volume per "Step" (BBLS/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 BBLS	Volume in GALS	Estimated Max. Static Pressure	Actual Tubing Pressure	Casing Pressure	Pump Rate	Notes
0	0	0	Initial				
Kill Point	Final ↓						
Overdisplace ↓							

FORMULAS

1. Pressure Gradient (psi/ft) = Mud Weight (ppg) x 0.052

2. Hydrostatic Pressure (psi) = Mud Weight (ppg) x 0.052 x Depth (ft, TVD)

3. Capacity (bbls/ft) = Inside Diameter^2 (in.) ÷ 1029.4

4. Annular Capacity(bbls/ft) = (Inside Diameter of Casing^2 (in.) or Hole Diameter^2 (in.) - Outside Diameter of Pipe^2 (in.)) ÷ 1029.4

5. Pipe Displacement (bbls/ft) = (Outside Diameter of pipe^2 (in.) - Inside Diameter of pipe^2 (in.)) ÷ 1029.4

6. Maximum Allowable Mud Weight (ppg) = $\frac{\text{Surface LOT Pressure (psi)}}{\text{Shoe Depth (ft, TVD) x 0.052}}$ + LOT Mud Weight (ppg)

7. MAASP (psi) = [Maximum Allowable Mud Weight (ppg) - Present Mud Weight (ppg)] x 0.052 x Shoe TVD (ft)

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

9. Sacks (100 lb) of Barite Needed to Weight-Up Mud = $\frac{\text{Bbls of Mud in System x 14.9 x (KMW - OMW)}}{\text{(35.4 - KMW)}}$

NOTE: This formula assumes that the average density of Barite is 35.4 ppg and the average number of sacks (100lb) per barrel is 14.9.

10. Volume Increase from Adding Barite (bbls) = Number of Sacks (100 lb) added ÷ 14.9

11. Equivalent Mud Weight (ppg) @ _____ depth (ft) = $\left[\frac{\text{Pressure (psi)}}{\text{Depth (ft, TVD) x 0.052}}\right]$ + Current Mud Weight (ppg)

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

13. Estimated New Pump Pressure with New Mud Weight (psi) = Old Pump Pressure (psi) x $\frac{\text{New Mud Weight (ppg)}}{\text{Old Mud Weight (ppg)}}$

COMMENTS