



TECHNICAL DATA BOOK

The Leader in Well Control

wildwell.com +1 281 784.4700



TECHNICAL

DATA BOOK

A quick reference book of
formulas, charts, and tables



A Superior Energy Services Company
© 2022 Wild Well Control, Inc.

The information contained herein has been collected from various sources. Accordingly, Wild Well Control, Inc. cannot and does not guarantee, warrant or represent the accuracy of or accept any responsibility for the use of any information contained herein.

wildwell.com +1.281.784.4700

Well Control Services

Firefighting and Well Control

Pressure Control

Hot Tap and Valve Drill

Freeze Services

WellCONTAINED™

Capping Stack Interface Check

Capping Stack Deployment Plans

Capping Stack Shut-in Plans

Sea Fastening Plans

Capping Stack Deployment Plans Shallow Water

Subsea Well Control Equipment

Well Control Engineering

Well Control (kick) Modeling

Dynamic Kill Modeling

Bullhead Modeling

Broach Modeling/Analysis

Relief Well Planning & Response

Advanced Engineering

Computational Fluid Dynamics

Flow Assurance and Thermal Engineering

Multi-Phase Flow Modeling

Erosion Analysis

Mechanical and Structural Design & Analysis

3D Laser Scanning and Survey

Training

Well Control Training

In-Person Courses

WellSHARP® Live Instructor-Led Well Control Training

Well Control Course Modules

In-House Courses

Acronyms & Abbreviations	2
Common Formulas & Equations	
Capacities & Volumes for Downhole	3
Capacities & Volumes of Tanks	4
Pump Output & Rate Formulas	5
Pump Pressure Relationships	5
Equivalent Circulating Density	6
Trip Calculations	6
Pressure & Gradient Formulas.....	7
Kick Related Formulas & Equations	
Kill Sheet Calculations	8
Kick Related Formulas	9
Kick Related Engineering Calculations	10
Volumetric Method Calculations	11
Lubricate & Bleed Calculations	12
Bullheading Calculations	12
Stripping / Snubbing Calculations.....	13
Subsea Formulas.....	15
Accumulator Sizing.....	15
Mud & Cement Formulas	17
Hydraulics Formulas	18
Estimates & Rules of Thumb	
Tripping	19
Stuck Pipe	20
Free Point and Stretch Estimates	21
Temperature Drop Across Choke or Orifice	22
Bit Nozzle Pressure Loss	22
Gas Well Flow Rates.....	23
Area of a Circle	23
Force and Pressure	24
Weight of Spiral Drill Collars.....	24
Buoyancy Factor.....	24
Surface and Bottom Hole Pressures in Full Gas Column	24
Pipe Elongation Due to Temperature	25
Pipe, BOP & Other Data Tables	
Drillpipe – Range II	27
Drillpipe Capacity & Displacement	29
Heavy-Weight Drillpipe	30
Drill Collars.....	31
Drill Collar Capacity & Displacement.....	33
KILL SHEET	34
API Tubing	36
Premium Connection Tubing.....	42
Casing Strength	44
Casing Capacity	47
Hole Capacity	49
Triplex Pumps at 100% Efficiency.....	50
Mud Weight Adjustments	53
Mud Weights	54
Specifications for BOP Flanges, etc.	56
Gate Valve Data	57
API Ring Joint Flanges	59
BOP Fluid Operating Volumes.....	62
Coiled Tubing Data	68
Coiled Tubing Dimensions	69
Electric Line	71
Wireline Data	74
Conversion Factors	75

Acronyms & Abbreviations

Unless otherwise defined, the following abbreviated terms are used in this book. Units are identified within specific formulas and equations

TERM	DESCRIPTION
bbl	Barrel
bpm	Barrels per minute
Cap	Capacity
Csg	Casing
DC	Drill collar
Disp	Displacement
DP	Drillpipe
DS	Drillstring
ECD	Equivalent circulating density
Eff	Efficiency
EMW	Equivalent mud weight
EOB	End of build
FCP	Final circulating pressure
FMDPP	Final maximum drillpipe pressure
FP	Formation pressure
ft	Foot
gal	Gallon
gpm	Gallons per minute
HP	Hydrostatic pressure
ICP	Initial circulating pressure
ID	Internal diameter
IMDPP	Initial maximum drillpipe pressure
KOP	Kick off point
KWM	Kill weight mud
MD	Measured depth
min	Minutes
MW	Mud weight
OD	Outer diameter
OMW	Original mud weight
pcf	Pounds per cubic foot
PP	Pump pressure
ppf	Pounds per foot
ppg	Pounds per gallon
psi	Pounds per square inch
PV	Plastic viscosity
Q	Flow rate
SF	Safety factor
SICP	Shut in casing pressure
SIDPP	Shut in drillpipe pressure
sk, sx	Sack, sacks
SPM	Strokes per minute
SPP	Slow pump pressure
stk	Stroke
TVD	True vertical depth
V	Velocity
Vol	Volume
YP	Yield point

Common Formulas & Equations

Capacities & Volumes for Downhole**Capacities****Open Hole Capacity_{bbl/ft} (OHCap) =**

$$\frac{(\text{Hole Diameter}_{\text{inches}})^2}{1,029.4}$$

$$\text{Casing Capacity}_{\text{bbl/ft}} (\text{CsgCap}) = \frac{(\text{Casing ID}_{\text{inches}})^2}{1,029.4}$$

$$\text{Drill String Capacity}_{\text{bbl/ft}} (\text{DSCap}) = \frac{(\text{Pipe ID}_{\text{inches}})^2}{1,029.4}$$

$$\text{OH x DS Annular Capacity}_{\text{bbl/ft}} (\text{OH x DSCap}) = \frac{(\text{Hole Diameter}_{\text{inches}})^2 - (\text{OD String}_{\text{inches}})^2}{1,029.4}$$

$$\text{Csg x DS Annular Capacity}_{\text{bbl/ft}} (\text{Csg x DSCap}) = \frac{(\text{Casing ID}_{\text{inches}})^2 - (\text{OD String}_{\text{inches}})^2}{1,029.4}$$

$$\text{Multiple String Annular Capacity}_{\text{bbl/ft}} (\text{MSACap}) = \frac{(\text{Casing ID}_{\text{inches}})^2 - [(\text{OD Pipe 1}_{\text{inches}})^2 + (\text{OD Pipe 2}_{\text{inches}})^2]}{1,029.4}$$

Volumes per Section

$$\text{Open Hole Volume}_{\text{bbl}} (\text{OHVol}) = \text{OHCap}_{\text{bbl/ft}} \times \text{Length}_{\text{ft}}$$

$$\text{Casing Volume}_{\text{bbl}} (\text{CsgVol}) = \text{CsgCap}_{\text{bbl/ft}} \times \text{Length}_{\text{ft}}$$

$$\text{Drill String Volume}_{\text{bbl}} (\text{DSVol}) = \text{DSCap}_{\text{bbl/ft}} \times \text{Length}_{\text{ft}}$$

$$\text{OH x DS Annular Volume}_{\text{bbl}} (\text{OH x DSVol}) = (\text{OH x DSCap})_{\text{bbl/ft}} \times \text{Length}_{\text{ft}}$$

$$\text{Csg x DS Annular Volume}_{\text{bbl}} (\text{Csg x DSVol}) = (\text{Csg x DSCap})_{\text{bbl/ft}} \times \text{Length}_{\text{ft}}$$

$$\text{Multiple String Annular Volume}_{\text{bbl}} (\text{MSAVol}) = \text{MSACap}_{\text{bbl/ft}} \times \text{Length}_{\text{ft}}$$

Common Formulas & Equations

Capacities & Volumes of Tanks**Vertical Cylindrical Tanks**

$$\text{Capacity}_{\text{bbl/ft}} = \frac{(\text{Tank Diameter}_{\text{ft}})^2}{7.148}$$

$$\text{Capacity}_{\text{bbl/ft}} = \frac{(\text{Tank Diameter}_{\text{inches}})^2}{1,029.4}$$

$$\text{Capacity}_{\text{bbl/inch}} = \frac{(\text{Tank Diameter}_{\text{ft}})^2}{85.78}$$

$$\text{Capacity}_{\text{bbl/inch}} = \frac{(\text{Tank Diameter}_{\text{inches}})^2}{12,352.9}$$

$$\text{Volume}_{\text{bbl}} = \text{Capacity}_{\text{bbl/ft}} \times \text{Height}_{\text{ft}}$$

$$\text{Volume}_{\text{bbl}} = \text{Capacity}_{\text{bbl/inch}} \times \text{Height}_{\text{inches}}$$

Rectangular Tanks

$$\text{Capacity}_{\text{bbl/ft}} = 0.178 \times \text{Length}_{\text{ft}} \times \text{Width}_{\text{ft}}$$

$$\text{Capacity}_{\text{bbl/inch}} = 0.0148 \times \text{Length}_{\text{ft}} \times \text{Width}_{\text{ft}}$$

$$\text{Volume}_{\text{bbl}} = \text{Capacity}_{\text{bbl/ft}} \times \text{Height}_{\text{ft}}$$

$$\text{Volume}_{\text{bbl}} = \text{Capacity}_{\text{bbl/inch}} \times \text{Height}_{\text{inches}}$$

Horizontal Cylindrical Tanks

$$\text{Volume of Tank}_{\text{bbl}} = \text{Length}_{\text{ft}} \times \frac{(\text{Tank Diameter}_{\text{inches}})^2}{1,029.4}$$

Content from Volume (for Horizontal Tanks)

$$\text{Height Ratio} = \frac{\text{Height of Content}_{\text{inches}}}{\text{Height of Tank}_{\text{inches}}}$$

FIND VOLUME FACTOR FROM TABLE USING CALCULATED HEIGHT RATIO:

$$\text{Content in Tank}_{\text{bbl}} = \text{Vol of Tank}_{\text{bbl}} \times \text{Volume Factor}$$

Height Ratio	Volume Factor	Height Ratio	Volume Factor
0.05	0.019	0.55	0.560
0.10	0.052	0.60	0.626
0.15	0.092	0.65	0.690
0.20	0.142	0.70	0.747
0.25	0.195	0.75	0.800
0.30	0.252	0.80	0.857
0.35	0.310	0.85	0.900
0.40	0.373	0.90	0.948
0.45	0.430	0.95	0.980
0.50	0.500	1.00	1.000

Common Formulas & Equations

Pump Output & Rate Formulas**Pump Outputs**

FOR TRIPLEX PUMPS:

$$\text{Output}_{\text{bbl/stk}} = 0.000243 \times (\text{Liner ID}_{\text{inches}})^2 \times \text{Stroke}_{\text{inches}} \times \text{Eff}\%$$

FOR DUPLEX PUMPS (DOUBLE ACTING):

$$\text{Output}_{\text{bbl/stk}} = 0.000162 \times [2 \times (\text{Liner ID}_{\text{inches}})^2 - (\text{Rod OD}_{\text{inches}})^2] \times \text{Stroke}_{\text{inches}} \times \text{Eff}\%$$

Pump Rates

$$\text{Rate}_{\text{bpm}} = \text{Output}_{\text{bbl/stk}} \times \text{SPM}$$

$$\text{Rate}_{\text{gpm}} = 42 \times \text{Output}_{\text{bbl/stk}} \times \text{SPM}$$

Pumping/Spotting/Displacing

$$\text{Time}_{\text{min}} = \frac{\text{BBL to Pump}}{\text{Output}_{\text{bbl/stk}} \times \text{SPM}}$$

Pump Pressure Relationships**New Pump Pressure (PP) for Rate Change**

$$\text{New PP}_{\text{psi}} = \left(\frac{\text{New Rate}_{\text{bpm}}}{\text{Old Rate}_{\text{bpm}}} \right)^2 \times \text{Old PP}_{\text{psi}}$$

$$\text{New PP}_{\text{psi}} = \left(\frac{\text{New SPM}}{\text{Old SPM}} \right)^2 \times \text{Old PP}_{\text{psi}}$$

New Pump Pressure (PP) for Density Change

$$\text{New PP}_{\text{psi}} = \frac{\text{New MW}_{\text{ppg}}}{\text{Original MW}_{\text{ppg}}} \times \text{Original PP}_{\text{psi}}$$

Common Formulas & Equations

Equivalent Circulating Density (ECD)**Equivalent Circulating Density (ECD_{ppg}) using Pressure Loss**

$$ECD_{ppg} = MW_{ppg} + \frac{\text{Annular Friction Pressure Loss}_{psi}}{0.052 \times \text{Depth}_{TVDFt}}$$

Where:

Annular Friction Pressure Loss in psi is approximately equal to 10% of the pump pressure for normal hole geometries (i.e., no liners or tapered strings).

Equivalent Circulating Density (ECD_{ppg}) using Yield Point (YP) for MW ≤ 13 ppg

$$ECD_{ppg} = MW_{ppg} + \frac{0.1 \times YP}{\text{HoleDiameter}_{inches} - \text{PipeOD}_{inches}}$$

Where:

YP = Fann 300 reading – PV

PV = Fann 600 reading – Fann 300 reading

Equivalent Circulating Density (ECD_{ppg}) using Yield Point (YP) for MW > 13 ppg

$$ECD_{ppg} = MW_{ppg} + \frac{0.1}{\text{HoleDiameter}_{inches} - \text{PipeOD}_{inches}} \times \left(YP + \frac{PV \times V_{ft/min}}{300 \times (\text{HoleDiameter}_{inches} - \text{PipeOD}_{inches})} \right)$$

Trip Calculations**Trip Margin_{ppg}**

$$\text{Trip Margin}_{ppg} = \frac{YP_{mud}}{11.7 \times (\text{Hole Diameter}_{inches} - \text{Pipe OD}_{inches})}$$

$$\text{Trip Margin}_{ppg} = \frac{\text{Annular Pressure Loss}_{psi}}{0.052 \times \text{Depth}_{TVDFt}}$$

Slug Mud Weight_{ppg} for a given Length of Dry Pipe

$$MW_{ppg} + \frac{\text{Slug Weight}_{ppg}}{\text{Volume of Slug}_{bbl}} = \frac{(MW_{ppg} \times \text{Length Dry Pipe}_{ft} \times DP \text{ Cap}_{bbl/ft})}{\text{Volume of Slug}_{bbl}}$$

Slug Volume_{bbl} for a given Length of Dry Pipe

$$\text{Slug Volume}_{bbl} = \frac{MW_{ppg} \times \text{Length Dry Pipe}_{ft} \times DP \text{ Cap}_{bbl/ft}}{\text{Slug MW}_{bbl} - MW_{ppg}}$$

Common Formulas & Equations

Trip Calculations, continued**Pit Gain from Slug_{bbl}**

$$\text{Pit Gain}_{\text{bbl}} = \text{Slug Volume}_{\text{bbl}} \times \frac{\text{Slug Weight}_{\text{ppg}} - \text{MW}_{\text{ppg}}}{\text{MW}_{\text{ppg}}}$$

Depth Slug Falls_{ft}

$$\text{Depth Slug Falls}_{\text{ft}} = \frac{\text{Pit Gain from Slug}_{\text{bbl}}}{\text{DP Cap}_{\text{bbl/ft}}}$$

Hydrostatic Pressure Drop per Vertical Foot ($\Delta P_{\text{psi/ft}}$) when Pulling Dry Pipe

$$\Delta P_{\text{psi/ft}} = \frac{0.052 \times \text{MW}_{\text{ppg}} \times \text{DP Displ}_{\text{bbl/ft}}}{\text{Annulus Cap}_{\text{bbl/ft}} + \text{DP Cap}_{\text{bbl/ft}}}$$

Hydrostatic Pressure Drop per Vertical Foot ($\Delta P_{\text{psi/ft}}$) when Pulling Wet Pipe

$$\Delta P_{\text{psi/ft}} = 0.052 \times \text{MW}_{\text{ppg}} \times \frac{(\text{DP Cap}_{\text{bbl/ft}} + \text{DP Displ}_{\text{bbl/ft}})}{\text{Annulus Cap}_{\text{bbl/ft}}}$$

Length of Dry Pipe Pulled Before Fill-Up for Desired Pressure Drop ΔP

$$\text{Length}_{\text{ft}} = \frac{\Delta P_{\text{psi}} \times (\text{Annulus Cap}_{\text{bbl/ft}} + \text{DP Cap}_{\text{bbl/ft}})}{0.052 \times \text{MW}_{\text{ppg}} \times \text{DP Displ}_{\text{bbl/ft}}}$$

Length of Wet Pipe Pulled Before Fill-Up for Desired Pressure Drop ΔP

$$\text{Length}_{\text{ft}} = \frac{\Delta P_{\text{psi}} \times \text{Annulus Cap}_{\text{bbl/ft}}}{0.052 \times \text{MW}_{\text{ppg}} \times (\text{DP Cap}_{\text{bbl/ft}} + \text{DP Displ}_{\text{bbl/ft}})}$$

Pressure & Gradient Formulas**Fluid Gradient (Gradient_{psi/ft})**

$$\text{Gradient}_{\text{psi/ft}} = 0.052 \times \text{Fluid Density}_{\text{ppg}}$$

$$\text{Gradient}_{\text{psi/ft}} = 0.007 \times \text{Fluid Density}_{\text{pcf}}$$

$$\text{Gradient}_{\text{psi/ft}} = 0.433 \times \text{Specific Gravity (SG)}$$

Hydrostatic Pressure (HP_{psi})

$$\text{HP}_{\text{psi}} = \text{Gradient}_{\text{psi/ft}} \times \text{Depth}_{\text{TVDft}}$$

$$\text{HP}_{\text{psi}} = 0.052 \times \text{MW}_{\text{ppg}} \times \text{Depth}_{\text{TVDft}}$$

$$\text{HP}_{\text{psi}} = 0.007 \times \text{MW}_{\text{pcf}} \times \text{Depth}_{\text{TVDft}}$$

$$\text{HP}_{\text{psi}} = 0.433 \times \text{SG} \times \text{Depth}_{\text{TVDft}}$$

Kick Related Formulas & Equations

Kill Sheet Calculations

(All formulas based on single bubble in water based mud.)

SEE SAMPLE KILL SHEET ON PAGE 34/35.

**Kill Weight Mud (KWM_{ppg}) from
Original Mud Weight (OMW_{ppg})**

$$\text{KWM}_{\text{ppg}} = \frac{\text{SIDPP}_{\text{psi}}}{(0.052 \times \text{Depth}_{\text{TVDft}})} + \text{OMW}_{\text{ppg}}$$

Initial Circulating Pressure (ICP_{psi})

$$\text{ICP}_{\text{psi}} = \text{SIDPP}_{\text{psi}} + \text{SPP}_{\text{psi}}$$

Final Circulating Pressure (FCP_{psi})

$$\text{FCP}_{\text{psi}} = \frac{\text{SPP}_{\text{psi}} \times \text{KWM}_{\text{ppg}}}{\text{OMW}_{\text{ppg}}}$$

Strokes to Bit (STB)

$$\text{STB} = \frac{\text{Drillstring Volume}_{\text{bbl}}}{\text{Output}_{\text{bbl/stk}}}$$

Strokes for KWM to Shoe

$$\text{Strokes to Shoe} = \frac{\text{Openhole Annular Volume}_{\text{bbl}}}{\text{Output}_{\text{bbl/stk}}} + \text{STB}$$

Strokes for KWM to Surface

$$\text{Strokes to Surface} = \frac{\text{Total Annular Volume}_{\text{bbl}}}{\text{Output}_{\text{bbl/stk}}} + \text{STB}$$

Time for KWM to Bit

$$\text{Time to Bit}_{\text{min}} = \frac{\text{STB}}{\text{SPM}}$$

Time for KWM to Shoe

$$\text{Time to Shoe}_{\text{min}} = \frac{\text{Strokes to Shoe}}{\text{SPM}}$$

Time for KWM to Surface

$$\text{Time to Surface} = \frac{\text{Strokes to Surface}}{\text{SPM}}$$

Kick Related Formulas & Equations

Kick Related Formulas

(All formulas based on single bubble in water based mud.)

Length of Influx

$$\text{Influx Length}_{\text{ft}} = \frac{\text{Influx Size}_{\text{bbl}}}{\text{Lower Annulus Cap}_{\text{bbl/ft}}}$$

Expected Pit Gain (MPG_{bbl}) with a Gas Kick in Water-Based Mud Systems

$$\text{MPG}_{\text{bbl}} = 4 \times \sqrt{\frac{\text{FP}_{\text{psi}} \times \text{Original Gain}_{\text{bbl}} \times \text{Annular Cap}_{\text{bbl/ft}}}{\text{KWM}_{\text{ppg}}}}$$

Expected Surface Pressure (MSP_{psi}) from a Gas Kick in Water-Based Mud Systems

$$\text{MSP}_{\text{psi}} = 0.20 \times \sqrt{\frac{\text{FP}_{\text{psi}} \times \text{Original Gain}_{\text{bbl}} \times \text{KWM}_{\text{ppg}}}{\text{Surface Annular Cap}_{\text{bbl/ft}}}}$$

Maximum Allowable Mud Weight (MAMW_{ppg})

$$\text{MAMW}_{\text{ppg}} = \frac{\text{Applied Pressure}_{\text{psi}}}{0.052 \times \text{Shoe Depth}_{\text{TVDft}}} + \text{Test MW}_{\text{ppg}}$$

Note: Applied Pressure from Integrity or Leak-Off test.

Maximum Allowable Shut-In Casing Pressure (MASP_{psi})

$$\text{MASP}_{\text{psi}} = 0.052 \times (\text{MAMW}_{\text{ppg}} - \text{MW}_{\text{ppg}}) \times \text{Shoe Depth}_{\text{TVDft}}$$

Kick Tolerance (KT_{ppg}) with Influx

$$\text{KT}_{\text{ppg}} = \left[(\text{MAMW}_{\text{ppg}} - \text{MW}_{\text{ppg}}) \times \frac{\text{Shoe Depth}_{\text{TVDft}}}{\text{Total Depth}_{\text{TVDft}}} \right] - \left[(\text{MW}_{\text{ppg}} - \text{MWI}_{\text{ppg}}) \times \frac{\text{Influx Height}_{\text{TVDft}}}{\text{Hole Depth}_{\text{TVDft}}} \right]$$

Where: MWI_{ppg} = Density of influx_{ppg}

Estimated Kick Density

$$\text{Kick Density}_{\text{ppg}} = \text{MW}_{\text{ppg}} - \frac{\text{SICP}_{\text{psi}} - \text{SIDPP}_{\text{psi}}}{0.052 \times \text{Kick Length}_{\text{TVDft}}}$$

Kick Gradient_{psi/ft}

$$\text{Kick Gradient}_{\text{psi/ft}} = (\text{MW}_{\text{ppg}} \times 0.052) - \frac{\text{SICP}_{\text{psi}} - \text{SIDPP}_{\text{psi}}}{\text{Kick Length}_{\text{TVDft}}}$$

Kick Related Formulas & Equations

Gas Migration Distance

$$\text{Distance}_{\text{TVDft}} = \frac{\text{Rise in SICP}_{\text{psi}}}{\text{MW}_{\text{ppg}} \times 0.052}$$

Rate of Gas Migration

$$\text{Migration Rate}_{\text{TVDft/min}} = \frac{\text{Distance of Rise}_{\text{TVDft}}}{\text{Time for Rise}_{\text{min}}}$$

Kick Related Engineering Calculations

(All formulas based on single bubble in water based mud.)

Bottom Hole Pressure (BHP_{psi}) while Circulating on the Choke

$$\text{BHP}_{\text{psi}} = \text{Hydrostatic Pressure}_{\text{psi}} \text{ Mud in Drillstring} + \text{SIDPP}_{\text{psi}}$$

Equivalent Mud Weight (EMW_{ppg}) at Bottom Hole while Circulating out a Kick

$$\text{EMW}_{\text{ppg}} = \frac{\text{BHP}_{\text{psi}}}{0.052 \times \text{Depth}_{\text{TVDft}}}$$

Shut-In Casing Pressure (SICP_{psi})

$$\text{SICP}_{\text{psi}} = \text{SIDPP}_{\text{psi}} + [0.052 \times (\text{MW}_{\text{ppg}} - \text{Kick Density}_{\text{ppg}}) \times \text{Length of Influx}_{\text{TVDft}}]$$

Formation Pressure (FP_{psi})

$$\begin{aligned} \text{FP}_{\text{psi}} &= \text{SIDPP}_{\text{psi}} + [0.052 \times \text{OMW}_{\text{ppg}} \times \text{Depth}_{\text{TVDft}}] \\ \text{FP}_{\text{psi}} &= \text{SICP} + 0.052 \times [(\text{Kick Length}_{\text{TVDft}} \times \text{Kick Density}_{\text{ppg}}) + (\text{Mud Column}_{\text{ft}} \times \text{OMW}_{\text{ppg}})] \end{aligned}$$

% Reduction in Hydrostatic Pressure Due to Gas-Cut Mud (GCMW) %ΔP_{gcm} (for water-base mud)

$$\% \Delta P_{\text{gcm}} = \frac{100 \times (\text{OMW}_{\text{ppg}} - \text{GCMW}_{\text{ppg}})}{\text{GCMW}_{\text{ppg}}}$$

Leak-Off Test Pressure (LOT_{psi}) and Equivalent Mud Weight (EMW_{LOT}) at Shoe

$$\text{LOT}_{\text{psi}} = 0.052 \times \text{Test MW}_{\text{ppg}} \times \text{TVD}_{\text{shoe}} + \text{Applied Pressure to Leak-Off}_{\text{psi}}$$

$$\text{EMW}_{\text{LOT ppg}} = \frac{\text{LOT}_{\text{psi}}}{0.052 \times \text{ShoeDepth}_{\text{TVDft}}}$$

Kick Related Formulas & Equations

Formation Integrity Test Pressure (FIT_{psi}) and Equivalent Mud Weight (EMW_{FIT}) at Shoe

$$\text{FIT}_{\text{psi}} = 0.052 \times \text{Test MW}_{\text{ppg}} \times \text{TVD}_{\text{shoe}} + \text{Applied Integrity Pressure}_{\text{psi}}$$

$$\text{EMW}_{\text{FIT ppg}} = \frac{\text{FIT}_{\text{psi}}}{0.052 \times \text{ShoeDepthTVDft}}$$

Maximum Formation Pressure that can be Controlled with a Well Shut-In

$$\text{Max FP}_{\text{psi}} = 0.052 \times (\text{KT}_{\text{ppg}} + \text{MW}_{\text{ppg}}) \times \text{DepthTVDft}$$

Kick Related Engineering Calculations, continued

(All formulas based on single bubble in water based mud.)

Maximum Kick Height Possible not to Exceed MASP

$$\text{Kick Height}_{\text{VDFt}} = \frac{\text{MASP}_{\text{psi}}}{\text{Mud Gradient}_{\text{psi/ft}} - \text{Kick Gradient}_{\text{psi/ft}}}$$

Maximum Kick Volume Possible not to Exceed MASP

$$\text{Kick Volume}_{\text{bbl}} = \text{Kick Height}_{\text{ft}} \times \text{Annulus Cap}_{\text{bbl/ft}}$$

Volumetric Method Calculations

Note: Not valid when hole is losing fluid.

(All formulas based on single bubble in water based mud.)

Initial Pressure Build Increment (ΔIP)

$$\Delta \text{IP}_{\text{psi}} = \text{Safety Margin}_{\text{psi}} + \text{Range}_{\text{psi}}$$

Cycle Pressure Build Increment (ΔCP)

$$\Delta \text{CP}_{\text{psi}} = \text{Range}_{\text{psi}}$$

Hydrostatic Pressure (ΔHPL_{psi/bbl}) Loss per Barrel of Mud Bled in Upper Annulus

$$\Delta \text{HPL}_{\text{psi/bbl}} = \frac{(\text{Gradient Mud} - 0.104)_{\text{psi/ft}}}{\text{Annulus Cap}_{\text{bbl/ft}} \text{ at top of hole}}$$

Bleed Volume (bbl) per Cycle

$$\text{Vol}_{\text{bleed}} = \frac{\Delta \text{CP}_{\text{psi}}}{\Delta \text{HPL}_{\text{psi / bbl}}}$$

Lubricate & Bleed Calculations

Note: Not valid when hole is losing fluid.

(All formulas based on single bubble in water based mud.)

Kick Related Formulas & Equations

Cycle Hydrostatic Pressure Gain ($\Delta HP_{\text{psi/bbl}}$) per Barrel of Mud Pumped in Upper Annulus

$$\Delta HP_{\text{psi/bbl}} = \frac{(\text{Gradient Lube Mud} - 0.104)_{\text{psi/ft}}}{\text{Annulus Cap}_{\text{bbl/ft at top of hole}}}$$

Cycle Hydrostatic Pressure Increase (ΔHPI_{psi}) or Lubricated Volume (ΔVOL_{bbl}) to be Bled Off

$$\Delta HPI_{\text{psi}} = \frac{(\text{Gradient Lube Mud} - 0.104)_{\text{psi/ft}} \times \Delta VOL_{\text{bbl}}}{\text{Annulus Cap}_{\text{bbl/ft at top of hole}}}$$

$$\Delta VOL_{\text{bbl}} = \frac{\Delta HPI_{\text{psi}} \times \text{Annulus Cap}_{\text{bbl/ft at top of hole}}}{(\text{Gradient Lube Mud} - 0.104)_{\text{psi/ft}}}$$

Lubricate & Bleed Calculations

(All formulas based on single bubble in water based mud.)

Simplified Equation for Lubrication

$$P_{3 \text{ psi}} = \frac{(P_{1 \text{ psi}})^2}{P_{2 \text{ psi}}}$$

Where:

P_1 = Original shut in pressure

P_2 = Pressure increase due to pumping lubricating fluid into the wellbore.

P_3 = pressure to bleed down after adding the hydrostatic of the lubricating fluid

Procedure:

1. Select a working pressure range. For example, $P_w = 50 - 100$ psi.
2. Pump lubricating fluid through the kill line to increase the casing pressure by the working pressure, so that $P_2 = P_1 + P_w$.
3. Allow the pressure to stabilize. The pressure may drop by a substantial amount.
4. Calculate the pressure (P_3) to bleed down to by using the formula above.
5. Repeat steps 2 through 4 until all the gas is lubricated out of the well.

Bullheading Calculations

Kill Weight Mud (KM_{ppg})

$$KWM_{\text{ppg}} = \frac{\text{Formation Pressure}_{\text{psi}}}{0.052 \times \text{Perfs Depth}_{\text{TVDft}}}$$

Kick Related Formulas & Equations

**Formation Integrity Pressure
(FIT_{psi}) at Perfs Depth**

$$\text{FIT}_{\text{psi}} = 0.052 \times (\text{EMW}_{\text{FIT ppg at perf}}) \times \text{Perfs}_{\text{TVDft}}$$

Hydrostatic Pressure (HP_{psi}) in Drillpipe

$$\text{HP}_{\text{psi}} = \text{Formation Pressure}_{\text{psi}} - \text{SIDPP}_{\text{psi}}$$

Initial Maximum Drillpipe Pressure (IMDPP_{psi})

$$\text{IMDPP}_{\text{psi}} = \text{FIT}_{\text{psi}} - \text{HP}_{\text{psi}}$$

Hydrostatic Pressure from KWM_{ppg} (KMHP_{psi})

$$\text{KMHP}_{\text{psi}} = 0.052 \times \text{KWM}_{\text{ppg}} \times \text{Perfs}_{\text{TVDft}}$$

Final Maximum Drillpipe Pressure (FMDPP_{psi})

$$\text{FMDPP}_{\text{psi}} = \text{FIT}_{\text{psi}} - \text{KMHP}_{\text{psi}}$$

Stripping/Snubbing Calculations
Breakover Point Between Stripping & Snubbing

$$\begin{aligned} \text{Snub Force}_{\text{lb}} &= \text{Wellbore Pressure}_{\text{psi}} \\ &\times (\text{DP or DC OD}_{\text{in}})^2 \times 0.7854 + \text{Friction Force}_{\text{lb}} \end{aligned}$$

$$\begin{aligned} \text{DC Weight}_{\text{lb}} &= \text{DC Weight}_{\text{lb/ft}} \times \text{DC Length}_{\text{ft}} \\ &\times \text{Buoyancy Factor} \end{aligned}$$

$$\begin{aligned} \text{DP Weight Required for Breakover}_{\text{lb}} \\ &= \text{Snub Force}_{\text{lb}} - \text{DC Weight}_{\text{lb}} \end{aligned}$$

$$\begin{aligned} \text{Length of DP Required for Breakover}_{\text{ft}} &= \\ &\frac{\text{DP Weight Required for Breakover}_{\text{lb}}}{\text{DP Weight}_{\text{lb/ft}} \times \text{Bouyancy Factor}} \end{aligned}$$

$$\text{Friction Force}_{\text{lb}} = \text{Friction Through Pressure Control Elements}$$

Influx Height Gain from Stripping Into

$$\begin{aligned} \Delta \text{Height}_{\text{ft}} &= \\ &\frac{\text{Pipe Length Stripped}_{\text{ft}} \times (\text{DPCap}_{\text{bbl/ft}} + \text{DPDispl}_{\text{bbl/ft}})}{\text{Annulus Cap}_{\text{bbl/ft}}} \end{aligned}$$

Kick Related Formulas & Equations

**Casing Pressure Increase (Δ SICP)
from Stripping into an Influx**

$$\Delta\text{SICP}_{\text{psi}} = \Delta\text{Height}_{\text{ft}} \times (\text{Gradient Mud} - \text{Gradient Influx})_{\text{psi/ft}}$$

**Mud Volume to Bleed to Maintain
Constant Bottom Hole Pressure**

$$\text{BleedMud}_{\text{bbl}} = \frac{\text{CsgPressureIncrement}_{\text{psi}} \times \text{Annulus Cap}_{\text{bbl/ft}}}{\text{Mud Gradient}_{\text{psi/ft}}}$$



Kick Related Formulas & Equations

Subsea Formulas**Hydrostatic Pressure in Riser (HPR_{psi})**

$$\text{HPR}_{\text{psi}} = (\text{Water Depth}_{\text{ft}} + \text{Air Gap}_{\text{ft}}) \times .052 \times \text{MW}_{\text{ppg}}$$

Hydrostatic Pressure from Seawater (HPS_{psi})

$$\text{HPS}_{\text{psi}} = .052 \times \text{Water Depth}_{\text{ft}} \times \text{Seawater Weight}_{\text{ppg}}$$

Riser Differential_{psi}

$$\text{Riser Differential}_{\text{psi}} = \text{HPR}_{\text{psi}} - \text{HPS}_{\text{psi}}$$

Riser Margin_{ppg}

$$\text{Riser Margin}_{\text{ppg}} = \frac{\text{Riser Differential}_{\text{psi}}}{0.052 \times (\text{TVD}_{\text{ft}} - \text{Water Depth}_{\text{ft}} - \text{Air Gap}_{\text{ft}})}$$

Pump Start-Up Pressure on Casing Side

$$\text{Pump Start-Up}_{\text{psi}} = \text{SICP}_{\text{psi}} - \text{CLFP}_{\text{psi}}$$

Where: CLFP_{psi} = Choke Line Friction Pressure

Initial Circulating Pressure (ICP_{psi})

$$\text{ICP}_{\text{psi}} = \text{SIDPP}_{\text{psi}} + \text{SPP}_{\text{psi}} \text{ through the riser}$$

Final Circulating Pressure (FCP_{psi})

$$\text{FCP}_{\text{psi}} = \text{SPP}_{\text{psi}} \text{ (through the riser)} \times \frac{\text{KWM}_{\text{ppg}}}{\text{OMW}_{\text{ppg}}}$$

Accumulator Sizing**API Minimum Requirements**

100% (S.F.= 1) of fluid volume required to close and hold closed all preventers and open an HCR valve and have a system pressure of 200 psi above minimum recommended precharge pressure remaining on the accumulator with pumps off.

Standard Recommendation

150% (S.F.= 1.5) of fluid volume required to close and hold closed all preventers and open an HCR valve and have 1,200 psi system pressure remaining on the accumulator with pumps off.

Fluid Volume Required (Vol_{reqd})

$$\begin{aligned} \text{Vol}_{\text{req}} = \text{S.F.} \times & (\text{CloseVol}_{\text{annular}} + \text{CloseVol}_{\text{bop1}} \\ & + \text{CloseVol}_{\text{bop2}} + \text{CloseVol}_{\text{bop3}} \\ & + \text{CloseVol}_{\text{bop4}} + \text{OpenVol}_{\text{hcr}}) \end{aligned}$$

Kick Related Formulas & Equations

Accumulator Sizing, continued

Accumulator Volume Required

Usable hydraulic fluid for operation of blowout preventer equipment is affected by system pressure and nitrogen precharge. If the nitrogen precharge is at the correct (recommended) precharge, multiply the sizing factor from the table below times the fluid volume required to operate a specified number of BOP functions (Vol_{req}) will provide the required total accumulator volume.

Accumulator System Pressure	Minimum Recommended Precharge Pressure	Useable Fluid	Accumulator Size Factor*
3,000	1,000 ¹	50.0%*	2
5,000	1,500 ¹	58.2%*	1.72

* Based on minimum system pressure of 200 psi over precharge.

¹ All precharge pressures should be in compliance with API 16D.

Precharge Pressure: The accumulator bottles filled with only precharge gas at its initial pressure and ambient temperature. The precharge pressure should be specified with a temperature. Precharge pressure is not to exceed the working pressure of the accumulator. Any precharge pressure less than the working pressure of the accumulator may be used as long as the functional requirements of pressure and volume and minimum design factors are satisfied.

Kick Related Formulas & Equations

Accumulator Volume Example

If the total fluid required for a BOP stack is 33 gallons, including the safety factor, and the accumulator has an operating pressure of 3,000 psi with a 1,000 psi minimum precharge, the accumulator volume required is 33 gallons times the size factor of 2, or 66 gallons.

Accumulator Usable Fluid Volume

Usable Volume = VR (Volume Required) x Bottle Volume

Where VR

$$= \frac{\text{Precharge Press}_{\text{psi}}}{\text{Min operating Press}_{\text{psi}}} - \frac{\text{Precharge Press}_{\text{psi}}}{\text{Max operating Press}_{\text{psi}}}$$

Mud & Cement Formulas

Barite (100 lb sx) Per 100 bbl Required for Weight-Up

$$\text{Sacks per 100 bbl} = 1,470 \times \frac{\text{KWM}_{\text{ppg}} - \text{OMW}_{\text{ppg}}}{35 - \text{KWM}_{\text{ppg}}}$$

Hematite (100 lb sx) Per 100 bbl Required for Weight-Up

$$\text{Sacks per 100 bbl} = 1,680 \times \frac{\text{KWM}_{\text{ppg}} - \text{OMW}_{\text{ppg}}}{40 - \text{KWM}_{\text{ppg}}}$$

Pit Volume Increase per 100 bbl ($\Delta V_{100\text{bbl}}$) due to Weight-Up with Barite

$$\Delta V_{100\text{bbl}} = 100 \times \frac{\text{KWM}_{\text{ppg}} - \text{OMW}_{\text{ppg}}}{35 - \text{KWM}_{\text{ppg}}}$$

Final Mud Weight (MW_{ppg}) when Mixing Two Densities of Mud

$$\text{MW}_{\text{ppg}} = \frac{(\text{Vol1}_{\text{bbl}} \times \text{MW1}_{\text{ppg}}) + (\text{Vol2}_{\text{bbl}} \times \text{MW2}_{\text{ppg}})}{\text{Vol1}_{\text{bbl}} + \text{Vol2}_{\text{bbl}}}$$

Initial Mud Volume Required (IVol_{bbl}) to Build a Final Volume of Mud with Barite

$$\text{IVol}_{\text{bbl}} = \text{Final Vol}_{\text{bbl}} \times \frac{35 - \text{KWM}_{\text{ppg}}}{35 - \text{OMW}_{\text{ppg}}}$$

Sacks of (94 lb) Cement Required

$$\text{Sacks}_{94\text{lb}} = \frac{5.615 \text{cf/bbl} \times \text{Cap}_{\text{bbl/ft}} \times \text{Length}_{\text{ft}} \times \% \text{Excess}}{\text{Yield}_{\text{cf/sk}}}$$

Kick Related Formulas & Equations

Mix Fluid Requirement

$$\text{Mix Fluid}_{\text{bbl}} = (\text{No. Sacks to Mix}) \times \frac{\text{Mix Fluid Req}_{\text{gal/sk}}}{42\text{gal/bbl}}$$

Balanced Plug (Cement, Barite, etc.)

A) Calculate volume of plug:

$$\text{PlugVol}_{\text{bbl}} = \text{Plug Length}_{\text{ft}} \times \text{Hole Cap}_{\text{bbl/ft}}$$

B) Calculate length of balanced column :

$$\text{Column Length}_{\text{ft}} = \frac{\text{PlugVol}_{\text{bbl}}}{\text{Annulus Cap}_{\text{bbl/ft}} + \text{DP Cap}_{\text{bbl/ft}}}$$

C) Calculate total string volume to balance:

$$\text{VolBalance}_{\text{bbl}} = (\text{Plug Bottom Depth}_{\text{ft}} - \text{Column Length}_{\text{ft}}) \times \text{DP cap}_{\text{bbl/ft}}$$

D) Calculate ratio of spacer inside and outside of string:

$$\text{Spacer Ratio} = \frac{\text{Annular Cap}_{\text{bbl/ft}}}{\text{DP Cap}_{\text{bbl/ft}}}$$

E) Calculate displacement volume:

$$\text{DisplVol}_{\text{bbl}} = \text{VolBalance}_{\text{bbl}} - \text{Spacer Behind}_{\text{bbl}}$$

Hydraulics Formulas**Annular Velocity (AV_{ft/min})**

$$V_{\text{ft/min}} = \frac{24.51 \times \text{Pump Rate}_{\text{gpm}}}{\text{HoleOD}_{\text{in}}^2 - \text{PipeOD}_{\text{in}}^2}$$

Hydraulic Horsepower (HHP)

$$\text{HHP} = \frac{Q_{\text{gpm}} \times \text{Pump Pressure}_{\text{psi}}}{1,714}$$

$$\text{HHP} = \frac{Q_{\text{bpm}} \times \text{Pump Pressure}_{\text{psi}}}{40.8}$$

Estimates & Rules of Thumb

Tripping Rules of Thumb

Ideally, drillers would like to keep bottomhole hydrostatic pressure constant during the trip out (POOH) and the trip in (RIH). However, this is impossible from the operational standpoint because of swab and surge pressures. Most tripping rules-of-thumb are closely associated with maintaining a safe hydrostatic overbalance that neither causes a kick nor lost circulation.

Slug Mud Weight Rule of Thumb

Slug mud weight is generally one ppg higher than the hole mud weight, with the objective being to unbalance the DP/annulus U-tube by enough to pull dry pipe. The condition of the mud, related to drill solids, and/or the mud weight range could influence the driller to accept less than one ppg.

Estimates & Rules of Thumb

Stuck Pipe

The causes of stuck pipe are broadly classified as differential or mechanical, and good monitoring and operating practices will minimize both types of pipe sticking. Differential sticking is caused by mud pressure overbalance and is influenced by drilling practices, type mud solids, permeability, bottom-hole assembly clearance, coefficient of friction and the lubricating characteristics of mud. Mechanical sticking is caused by deterioration of hole stability (shale problems, hole cleaning, etc.) and/or directional (crooked-hole) problems.

Rule of Thumb for Differentially Stuck Pipe

The estimated force required to pull free is equal to the contact force per unit length, times the length of pipe in contact with permeable formation times the coefficient of friction. This estimate tends to be more accurate in a straight hole than in a directional well.

Estimating Formula for Differential Sticking

$$F_{\text{diff}} = K (\Delta P) \text{ Area}$$

Where:

K = Sticking coefficient (0.2 water base mud)

(ΔP) = Differential pressure (psi)

d = Diameter (inches)

L = Permeable zone length (feet)

Area = Contact area (inches²)

$$\text{Area} = L \times \left(\frac{12 \text{ in.}}{\text{ft}} \right) \times \left(\frac{\pi \times d}{3} \right)$$

(assume $\frac{1}{3}$ of the drill collar circumference is buried)

Circumference = $\pi \times \text{Diameter}$

Conclusion: Force to pull free increases as the length of pipe in contact with permeable formation increases, and as the coefficient of friction between pipe and wall increases.

Example

Given 6 $\frac{1}{4}$ " DC:

$$\frac{\pi \times d}{3} = \frac{3.1416 \times 6.25}{3} = 6.545 \quad (\text{round to } 6.5)$$

$\Delta P = 200 \text{ psi}$ (approx. 0.5 ppg overbalance at 8,000 ft)

L = 200 ft (of permeable zone)

$$F_{\text{diff}} = 0.2 \times 200_{\text{psi}} \times 200_{\text{ft}} \times 12_{\text{in./ft}} \times 6.5_{\text{in.}} = 624,000_{\text{lbs}}$$

Estimates & Rules of Thumb

Free Point and Stretch Estimates

When the drill string is stuck, the free point method can be used to estimate the amount of free pipe in the hole.

Begin by pulling on the pipe with an initial force (F_i) that is at least 1,000 pounds more than the hanging weight of the string, and make a reference mark on the string. Increase the pull by increments (for example, 5,000 lbs) to final force (F_f) to determine a measurable stretch. Mark the string again, measure the distance between the marks and record as the stretch (S) in inches. Record the difference between F_f and F_i as the pull increment (PI). The amount of free pipe (L) in 1,000's of feet below the rotary can then be estimated. These estimates tend to be more accurate in straight holes than in directional wells.

Estimating Formula

The formula for free pipe length L is:

$$L = 1.9635 \times S \times \frac{OD^2 - ID^2}{PI}$$

The formula for pipe stretch S is:

$$S = \frac{PI \times L}{1.9635 \times (OD^2 - ID^2)}$$

Where:

- L = Length of free pipe (1,000s ft)
- S = Stretch (inches)
- OD = OD of the pipe (inches)
- ID = ID of the pipe (inches)
- PI = Pull increment (1,000s lbs) = $F_f - F_i$

Example

Given:

- | | |
|---------------------------------|-------------------|
| Drillpipe size = 5", 19.5 lb/ft | $F_i = 5,000$ lb |
| $OD = 5"$ | $F_f = 35,000$ lb |
| $ID = 4.276"$ | $S = 12"$ |

Calculate:

$$PI = 35 - 5 = 30$$

$$L = 1.9635 \times 12 \times \frac{25 - 18.284}{30} = 5.27 \text{ thousand feet}$$

Estimating Temperature Drop Across a Choke or Orifice

Estimates & Rules of Thumb

Rule of Thumb

The temperature drop across a choke or orifice is about one degree Fahrenheit (F) per each pressure drop of one atmosphere (rounded at 15 psi).

Estimating Formula

$$T_{\text{drop}} = \frac{(P_h - P_L)}{\text{atm}} \times 1^\circ\text{F}$$

Where:

T_{drop} = Temperature drop (degrees)

P_h = Gas pressure before the choke (psi)

P_L = Gas pressure after the choke (psi)

atm = Atmospheric pressure (15 psi)

Example

Calculate temperature drop if the gas pressure is reduced from 1,000 psi to 500 psi across a choke.

$$T_{\text{drop}} = \frac{(1,000 - 500)}{\text{atm}} \times 1^\circ\text{F}$$

$$= 33 \times 1^\circ\text{F} = 33^\circ\text{F temperature drop}$$

Bit Nozzle Pressure Loss

$$\Delta P = \frac{\rho \times Q^2}{10858 \times A^2}$$

Where:

ΔP = Pressure (psi)

ρ = Density (ppg)

Q = Circulation rate (gal/min)

A = Area of the nozzle (in²)

Estimates & Rules of Thumb

Estimating Gas Well Flow Rates

Rule of Thumb

The approximate flow rate (in mmscfd) of a gas well through a blowdown line choke can be estimated by multiplying 24 hours/day, times the tubing pressure plus 15, times the square of the choke size in inches and divide by 1,000.

Estimating Formula

$$Q = \frac{24 \times (P_L + 15) \times (D_{ch})^2}{1,000}$$

Where:

Q = Flowrate (mmscfd)

P_L = Pressure upstream of choke (psi)

D_{ch} = Choke size (inches)

Example

Calculate the estimated flowrate of a gas well, given that tubing pressure is 3,500 psi, and choke size is 1/4.

$$Q = \frac{24 \times (3,500 + 15) \times (0.25)^2}{1,000} = 5.273 \text{ mmscfd}$$

Area of a Circle (in²)

$$0.7854 \times D^2$$

$$\text{or } \pi D^2/4$$

$$\text{or } \pi R^2$$

Where:

D = diameter (inches)

R = radius (inches)

Estimates & Rules of Thumb

Force and Pressure

$$\text{Force}_{\text{lb}} = \text{Pressure}_{\text{psi}} \times \text{Area}_{\text{sq in}}$$

Weight of Spiral Drill Collars

$$\begin{aligned} &\text{ppf for spiral DC} \\ &= 0.96 \times \text{ppf for smooth DC of same OD \& ID} \end{aligned}$$

Buoyancy Factor (BF)

$$\text{BF} = \frac{65.4 - \text{MW}_{\text{ppg}}}{65.4}$$

Surface & Bottom Hole Pressures in Full Gas Column

Method A – Approximate gas gradient is 0.1 psi/ft

$$\text{SP} = \text{BHP} - (0.1_{\text{psi/ft}} \times \text{TVD}_{\text{ft}})$$

Method B – Exact equation

$$\text{SP} = \text{BHP} \times e^{-\left(\frac{0.01875 \times \text{SG} \times \text{D}}{Z_{\text{avg}} \times T_{\text{avg}}}\right)}$$

Where:

SP = Surface Pressure (psi)

BHP = Bottom hole pressure (psi)

SG = Specific gravity of the gas

D = Depth in TVD (feet)

Z_{avg} = Average compressibility factor of the gas

T_{avg} = Average gas temp in degrees Rankine ($^{\circ}\text{F} + 460$)

Estimates & Rules of Thumb

Pipe Elongation Due to Temperature

Since the well has higher temperatures than the air above ground, an elongation will take place.

Rule of Thumb

Pipe will elongate about 0.83 inches, per 100 feet of length, per 100 degree F increase in temperature. Knowing the surface temperature and the average temperature of the well, the elongation can be estimated.

Note: Elongation (stretch) is also caused by the hanging weight of pipe.

Estimating Formulas

$$BHT = \left(\frac{1^\circ\text{F}}{100\text{ft}} \times \text{TVD} \right) + ST^\circ\text{F}$$

$$T_a = \frac{BHT + ST}{2}$$

$$\Delta T = T_a - \text{Surface Temp}$$

$$\Delta L_T = 12\text{in/ft} \times 0.0000069 \frac{\text{in/in}}{^\circ\text{F}} \times L \times \Delta T$$

$$\Delta L_T = \frac{L}{100\text{ft}} \times \frac{\Delta T}{100^\circ\text{F}} \times 0.83$$

Where:

- BHT = Bottomhole temperature (°F)
- Depth = True vertical depth (ft)
- ST = Surface temperature (°F)
- T_a = Average temperature (°F)
- ΔT = Change in average temperature (°F)
- ΔL_T = Elongation (inches)
- L = Length of pipe (ft)

Estimates & Rules of Thumb

My Rules of Thumb

Pipe Size	Norm. Wt.	Wall Thick.	Pipe ID	Plain End Wt.	Upset Wt.	Pipe End Dia.	Pipe End Dia. OD	API Designation	OD	ID	Length	Weight	with Tool Joint Capacity	without Tool Joint Capacity	Displ.
In.	lb/ft	In.	In.	lb/ft	lb	In.	In.		In.	In.	ft	lb	bbbls/ft	bbbls/ft	Displ. bbls/ft
External Upset – Grade E															
2 7/8	10.40	0.362	2.151	9.72	2.40	2.151	3.219	OH	3.875	2.156	1.29	34.99	0.00451	0.00389	0.00353
3 1/2	13.30	0.368	2.764	12.31	4.00	2.602	3.824	NC 38 (IF)	4.750	2.688	1.54	61.10	0.00741	0.00515	0.00448
3 1/2	15.50	0.449	2.602	14.63	2.80	2.602	3.824	NC 38 (IF)	5.000	2.563	1.59	74.82	0.00658	0.00606	0.00532
Internal External Upset – Grade X															
5	19.50	0.362	4.276	17.93	16.80	3.653	5.188	NC 50 (EH)	6.375	3.500	1.65	120.23	0.01745	0.00784	0.00652
External Upset – Grade G															
4	14.00	0.330	3.340	12.93	14.40	3.063	4.625	NC 46 (IF)	6.000	3.250	1.70	108.76	0.01082	0.00587	0.00471
4 1/2	16.60	0.337	3.826	14.98	17.20	3.563	5.188	NC 50 (IF)	6.375	3.750	1.67	113.10	0.01421	0.00663	0.00545
Internal External Upset – Grade G															
4 1/2	20.00	0.430	3.640	18.69	17.60	2.813	4.250	NC 46 (EH)	6.250	2.500	1.71	142.46	0.01252	0.00830	0.00680
5	19.50	0.362	4.276	17.93	16.80	3.563	5.188	NC 50 (IF)	6.625	2.750	1.70	157.37	0.01719	0.00827	0.00652
5	25.60	0.500	4.000	24.03	15.40	3.313	5.188	5 1/2 FH	7.250	3.250	1.82	188.17	0.01523	0.01075	0.00874
5	25.60	0.500	4.000	24.03	15.40	3.313	5.188	5 1/2 FH	7.250	3.500	1.82	179.97	0.01535	0.01066	0.00874
5 1/2	21.90	0.361	4.778	19.81	21.00	3.813	5.563	5 1/2 FH	7.250	3.500	1.79	184.41	0.02162	0.00925	0.00721
Internal External Upset – Grade S															
5 1/2	21.90	0.361	4.778	19.81	21.00	3.813	5.563	HT 55	7.000	4.000	2.33	199.19	0.02172	0.00925	0.00721
5 1/2	24.70	0.415	4.670	22.54	18.40	3.813	5.563	HT 55	7.000	3.750	2.31	210.15	0.02067	0.01042	0.00820
5 7/8	23.40	0.361	5.153	N/A	N/A	N/A	N/A	N/A	7.000	4.25	N/A	N/A	0.02521	0.00971	0.00773
6 5/8	25.20	0.330	5.965	22.19	25.87	5.315	6.929	HT 65	8.000	5.000	2.35	240.81	0.03385	0.01078	0.00807
6 5/8	27.70	0.362	5.901	24.21	24.00	5.315	6.929	HT 65	8.000	4.750	2.39	284.15	0.03297	0.01194	0.00881

Drillpipe Capacity & Displacement

DP OD	Weight	ID Tube	DP Capacity	Displacement	Closed-End
In.	ppf	In.	bbl/ft	bbl/ft	bbl/ft
2 3/8	4.85	1.995	0.00387	0.0016	0.0055
	6.65	1.815	0.00320	0.0023	0.0055
2 7/8	6.45	2.469	0.00592	0.0021	0.0080
	6.85	2.441	0.00579	0.0022	0.0080
	8.35	2.323	0.00524	0.0028	0.0080
	10.40	2.151	0.00449	0.0035	0.0080
3 1/2	8.50	3.063	0.00911	0.0028	0.0119
	9.50	2.992	0.00870	0.0032	0.0119
	11.20	2.900	0.00817	0.0037	0.0119
	13.30	2.764	0.00742	0.0045	0.0119
	15.50	2.602	0.00658	0.0053	0.0119
4	11.85	3.476	0.01174	0.0038	0.0155
	14.00	3.340	0.01084	0.0047	0.0155
	15.70	3.240	0.01020	0.0053	0.0155
4 1/2	12.75	4.000	0.01554	0.0041	0.0197
	13.75	3.958	0.01522	0.0045	0.0197
	16.60	3.826	0.01422	0.0055	0.0197
	20.00	3.640	0.01287	0.0068	0.0197
5	16.25	4.408	0.01888	0.0054	0.0243
	19.50	4.276	0.01776	0.0065	0.0243
	20.50	4.214	0.01725	0.0070	0.0243
5 1/2	21.90	4.778	0.02218	0.0072	0.0294
	24.70	4.670	0.02119	0.0082	0.0294
5 7/8	23.40	5.153	0.02579	0.0077	0.0335
	26.30	5.045	0.02472	0.0088	0.0335
	28.67	4.875	0.02309	0.0104	0.0335
6 5/8	22.20	6.065	0.03573	0.0069	0.0426
	25.20	5.965	0.03456	0.0081	0.0426
	31.90	5.761	0.03224	0.0104	0.0426
7 5/8	29.25	6.969	0.04718	0.0093	0.0565

Note: Capacity and displacement value are without tool joint.

Nominal Size	Nominal Tube Dimensions		Tool Joint			Approx. Weight Tube & Joints	Make-up Torque	Capacity	Displacement
	Inside Dia.	Wall Thickness	Connection Size	Outside Diameter	Inside Diameter				
In.	In.	In.	In.	In.	In.	lb/ft	Ft/lb	bbls/ft	bbls/ft
3 1/2	2 1/16	0.719	NC 38 (3 1/2 IF)	4 3/4	2 3/16	25.3	9,900	0.0042	0.0092
3 1/2	2 1/4	0.625	NC 38 (3 1/2 IF)	4 3/4	2 3/8	23.2	9,900	0.0050	0.0084
4	2 9/16	0.719	NC 40 (4 FH)	5 1/4	2 11/16	27.2	13,250	0.0073	0.0100
4 1/2	2 3/4	0.875	NC 46 (4 IF)	6 1/4	2 7/8	41.0	21,800	0.0074	0.0149
5	3	1.000	NC 50 (4 1/2 IF)	6 5/8	3 1/16	49.3	29,400	0.0088	0.0179
5 1/2	3 3/8	1.063	5 1/2 FH	7	3 1/2	57.0	33,200	0.0111	0.0207
6 5/8	4 1/2	1.063	6 5/8 FH	8	4 1/2	70.8	46,900	0.0196	0.0257

OD	ID Capacity	1 1/2"	1 3/4"	2"	2 1/4"	2 1/2"	2 3/4"	3"	3 1/4"	3 1/2"	3 3/4"
4"	Wt lb/ft	36.7	34.5	32.0	29.2	-	-	-	-	-	-
	Disp bbl/ft	0.0133	0.0125	0.0116	0.0106	-	-	-	-	-	-
4 1/4"	Wt lb/ft	42.2	40.0	37.5	34.7	-	-	-	-	-	-
	Disp bbl/ft	0.0153	0.0145	0.0136	0.0126	-	-	-	-	-	-
4 1/2"	Wt lb/ft	48.1	45.9	43.4	40.6	-	-	-	-	-	-
	Disp bbl/ft	0.0175	0.0167	0.0158	0.0148	-	-	-	-	-	-
4 3/4"	Wt lb/ft	54.3	52.1	49.6	46.8	43.6	-	-	-	-	-
	Disp bbl/ft	0.0197	0.0189	0.0181	0.0170	0.0159	-	-	-	-	-
5"	Wt lb/ft	60.8	58.6	56.1	53.3	50.1	-	-	-	-	-
	Disp bbl/ft	0.0221	0.0213	0.0204	0.0194	0.0182	-	-	-	-	-
5 1/4"	Wt lb/ft	67.6	65.4	62.9	60.1	56.9	53.4	-	-	-	-
	Disp bbl/ft	0.0246	0.0238	0.0229	0.0219	0.0207	0.0194	-	-	-	-
5 1/2"	Wt lb/ft	74.8	72.6	70.1	67.3	64.1	60.6	56.8	-	-	-
	Disp bbl/ft	0.0272	0.0264	0.0255	0.0245	0.0233	0.0221	0.0207	-	-	-
5 3/4"	Wt lb/ft	82.3	80.1	77.6	74.8	71.6	68.1	64.3	-	-	-
	Disp bbl/ft	0.0299	0.0291	0.0282	0.0272	0.0261	0.0248	0.0234	-	-	-
6"	Wt lb/ft	90.1	87.9	85.4	82.6	79.4	75.9	72.1	67.9	63.4	-
	Disp bbl/ft	0.0328	0.0320	0.0311	0.0301	0.0289	0.0276	0.0262	0.0247	0.0231	-
6 1/4"	Wt lb/ft	98.0	95.8	93.3	90.5	87.3	83.8	80.0	75.8	71.3	-
	Disp bbl/ft	0.0356	0.0349	0.0339	0.0329	0.0318	0.0305	0.0291	0.0276	0.0259	-
6 1/2"	Wt lb/ft	107.0	104.8	102.3	99.5	96.3	92.8	89.0	84.8	80.3	-
	Disp bbl/ft	0.0389	0.0381	0.0372	0.0362	0.0350	0.0338	0.0324	0.0308	0.0292	-

OD	ID Capacity	1 1/2"	1 3/4"	2"	2 1/4"	2 1/2"	2 3/4"	3"	3 1/4"	3 1/2"	3 3/4"
6 3/4"	Wt lb/ft	116.0	113.8	111.3	108.5	105.3	101.8	98.0	93.8	89.3	-
	Disp bbl/ft	0.0422	0.0414	0.0405	0.0395	0.0383	0.0370	0.0356	0.0341	0.0325	-
7"	Wt lb/ft	125.0	122.8	120.3	117.5	114.3	110.8	107.0	102.8	98.3	93.4
	Disp bbl/ft	0.0455	0.0447	0.0438	0.0427	0.0416	0.0403	0.0389	0.0374	0.0358	0.0340
7 1/4"	Wt lb/ft	134.0	131.8	129.3	126.5	123.3	119.8	116.0	111.8	107.3	102.4
	Disp bbl/ft	0.0487	0.0479	0.0470	0.0460	0.0449	0.0436	0.0422	0.0407	0.0390	0.0372
7 1/2"	Wt lb/ft	144.0	141.8	139.3	136.5	133.3	129.8	126.0	121.8	117.3	112.4
	Disp bbl/ft	0.0524	0.0516	0.0507	0.0497	0.0485	0.0472	0.0458	0.0443	0.0427	0.0409
7 3/4"	Wt lb/ft	154.0	151.8	149.3	146.5	143.3	139.8	136.0	131.8	127.3	122.4
	Disp bbl/ft	0.0560	0.0552	0.0543	0.0533	0.0521	0.0509	0.0495	0.0479	0.0463	0.0445
8"	Wt lb/ft	165.0	162.8	160.3	157.5	154.3	150.8	147.0	142.8	138.3	133.4
	Disp bbl/ft	0.0600	0.0592	0.0583	0.0573	0.0561	0.0549	0.0535	0.0520	0.0503	0.0485
8 1/4"	Wt lb/ft	176.0	173.8	171.3	168.5	165.3	161.8	158.0	153.8	149.3	144.4
	Disp bbl/ft	0.0640	0.0632	0.0623	0.0613	0.0601	0.0589	0.0575	0.0560	0.0543	0.0525
8 1/2"	Wt lb/ft	187.0	184.8	182.3	179.5	176.3	172.8	169.0	164.8	160.3	155.4
	Disp bbl/ft	0.0680	0.0672	0.0663	0.0653	0.0641	0.0629	0.0615	0.0600	0.0583	0.0565
8 3/4"	Wt lb/ft	199.0	196.8	194.3	191.5	188.3	184.8	181.0	176.8	172.3	167.4
	Disp bbl/ft	0.0724	0.0716	0.0707	0.0697	0.0685	0.0672	0.0658	0.0643	0.0627	0.0609
9"	Wt lb/ft	210.2	208.0	205.6	202.7	199.6	196.0	192.2	188.0	183.5	178.7
	Disp bbl/ft	0.0765	0.0757	0.0748	0.0738	0.0726	0.0714	0.0700	0.0685	0.0668	0.0651
10"	Wt lb/ft	260.9	258.8	256.3	253.4	250.3	246.8	242.9	238.8	234.3	229.4
	Disp bbl/ft	0.0950	0.0942	0.0933	0.0923	0.0911	0.0898	0.0884	0.0869	0.0853	0.0835

Drill Collar Capacity & Displacement

DC OD	DC ID	DC Capacity	Steel Displ.	Closed-End
In.	In.	bbl/ft	bbl/ft	bbl/ft
3 1/8	1.250	0.00152	0.0080	0.0095
3 3/4	1.500	0.00219	0.0115	0.0137
4 1/8	2.000	0.00389	0.0126	0.0165
4 3/4	2.000	0.00389	0.0181	0.0219
6	2.250	0.00492	0.0301	0.0350
6 1/4	2.500	0.00607	0.0318	0.0379
6 1/2	2.500	0.00607	0.0350	0.0410
8	2.813	0.00768	0.0545	0.0622
8 1/4	2.875	0.00803	0.0589	0.0661
8 1/2	2.875	0.00803	0.0622	0.0629
9	2.875	0.00803	0.0707	0.0787
9 1/2	2.875	0.00803	0.0796	0.0877
10	2.875	0.00803	0.0891	0.0971
10 1/2	2.875	0.00803	0.0991	0.1071
11	2.875	0.00803	0.1095	0.1175
11 1/2	2.875	0.00803	0.1204	0.1285
12	2.875	0.00803	0.1319	0.1399

Well Data

Date _____
TD _____ | TVD _____
Mud weight _____ ppg
Slow pump _____ psi @ _____ SPM
Fast pump _____ psi @ _____ SPM
Pump output _____ bbl/stk

Drill String Capacity

Sec. A _____ bbl
Sec. B _____ bbl
Sec. C _____ bbl
Sec. D _____ bbl
Sec. E _____ bbl
Total _____ bbl

Annulus Capacity

Sec. F _____ bbl
Sec. G _____ bbl
Sec. H _____ bbl
_____ bbl
_____ bbl
_____ bbl
Total _____ bbl

Kick Data

SIDP _____ psi | SICP _____ psi
Volume gained _____ bbl
Old mud weight (OMW) _____ ppg
Bit at _____ ft

Kill Data ("Wait & Weight" Method)

Kill rate (slow or fast pump) = _____ SPM
Kill weight mud (KWM) = $OMW + \frac{SIDPP}{0.052 \times TVD}$ = _____ ppg
Initial circulation pressure (ICP) = SIDP + Kill rate pressure = _____ psi
Final circulation pressure (FCP) = Kill rate pressure x $\frac{KWM}{OMW}$ = _____ psi
Surface to bit _____ strokes | Bit to surface _____ strokes
One circulation _____ strokes

Kill Schedule ("Wait & Weight" Method)

Strokes	Volumes	Drillpipe Press	Strokes	Volume	Drillpipe Press
0	0	ICP			
			To Bit		FCP

KILL CHART

STROKES

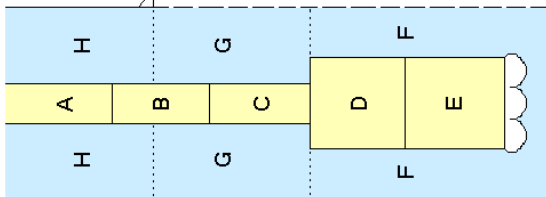
NOTE: Enlarge page by 125% to get 8½ x 11" full-size worksheet.

Casing size _____

Set at _____

Bit at _____ ft

TD at _____ ft



Tubing Size		Nominal Weight		Grade	Wall Thickness	Inside Dia.	Threaded & Coupled				Collapse Resistance	Internal Yield Pressure	Joint Yield Strength		Capacity	Displacement	
Nominal	OD	T&C Non-Upset	T&C Upset				Drift Dia.	Non-Upset	Upset Reg.	Upset Spec.			T&C Non-Upset	T&C Upset		T&C Non-Upset	T&C Upset
In.	In.	lb/ft	lb/ft		In.	In.	In.	In.	In.	In.	psi	psi	psi	psi	psi	bbl/ft	bbl/ft
3/4	1.050	1.14	1.20	H-40	0.113	.824	.730	1.313	1.660	N/A	7,680	7,530	6,320	13,320	0.00066	0.00041	0.00044
				J-55							10,560	10,360	8,690	18,320			
				C-75							14,410	14,120	11,920	24,940			
				N-80							15,370	15,070	12,640	26,640			
1	1.315	1.70	1.80	H-40	0.133	1.049	.955	1.660	1.900	N/A	7,270	7,080	10,920	19,760	0.00107	0.00062	0.00065
				J-55							10,000	9,730	15,020	27,170			
				C-75							13,640	13,270	20,540	37,040			
				N-80							14,550	14,160	21,840	39,520			
1 1/4	1.660	2.30	2.40	H-40	0.125	1.410	1.286	2.054	2.200	N/A	5,570	5,270	N/A	N/A	0.00193	N/A	N/A
				H-40							6,180	5,900	15,480	26,760			
				J-55							8,490	8,120	21,290	36,800		0.00185	0.00084
				C-75							11,580	11,070	29,120	50,140			
				N-80							12,360	11,810	30,960	53,520			

Tubing Size		Nominal Weight		Grade	Wall Thick.	Inside Dia.	Threaded & Coupled			Collapse Resistance	Internal Yield Pressure	Joint Yield Strength		Capacity	Displacement	
Nominal	OD	T&C Non-Upset	T&C Upset				Drift Dia.	Non-Upset	Upset Reg.	Upset Spec.		T&C Non-Upset	T&C Upset		T&C Non-Upset	T&C Upset
In.	In.	lb/ft	lb/ft		In.	In.	In.	In.	In.	In.	psi	lb	lb	bb/ft	bb/ft	bb/ft
1 1/2	1.900	2.75	2.90	H-40	0.145	1.610	1.516	2.200	2.500	N/A	5,640	19,040	31,960	0.00252	0.00100	0.00106
				J-55							7,350	26,180	43,950			
				C-75							10,570	35,800	59,960			
				N-80							11,280	38,080	63,920			
2 1/16	2.063	N/A	N/A	H-40	0.156	1.751	N/A	N/A	N/A	N/A	5,290	N/A	N/A	0.00298	N/A	N/A
				J-55							7,280					
				C-75							9,920					
				N-80							10,590					

Tubing Size		Nominal Weight		Grade	Wall Thick.	Inside Dia.	Threaded & Coupled			Collapse Resistance	Internal Yield Pressure	Joint Yield Strength		Capacity	Displacement	
Nominal	OD	T&C Non-Upset	T&C Upset				Drift Dia.	Coupling Outside Diameter				T&C Non-Upset	T&C Upset		T&C Non-Upset	T&C Upset
In.	In.	lb/ft	lb/ft		In.	In.	In.	Non-Upset	Upset Reg.	Upset Spec.	psi	psi	lb	bb/ft	bb/ft	bb/ft
2 3/8	2.375	4.00	N/A	H-40	0.167	2.041	1.947	2.875	N/A	N/A	5,230	4,920	30,130	N/A	0.00405	0.00146
		4.60	4.70	H-40	0.190	1.995	1.901	2.875	3.063	2.910	5,890	5,600	52,170	0.00387	0.00167	0.00171
		4.60	4.70	J-55	0.190	1.995	1.901	2.875	3.063	2.910	8,100	7,700	71,730	0.00387	0.00167	0.00171
		4.60	4.70	C-75	0.190	1.995	1.901	2.875	3.063	2.910	11,040	10,500	97,820	0.00387	0.00167	0.00171
		5.80	5.95	C-75	0.254	1.867	1.773	2.875	3.063	2.910	14,330	14,040	126,940	0.00339	0.00211	0.00216
		4.60	4.70	N-80	0.190	1.995	1.901	2.875	3.063	2.910	11,780	11,200	104,340	0.00387	0.00167	0.00171
		5.80	5.95	N-80	0.254	1.867	1.773	2.875	3.063	2.910	15,280	14,970	135,400	0.00339	0.00211	0.00216
		4.60	4.70	P-105	0.190	1.995	1.901	2.875	3.063	2.910	15,460	14,700	136,940	0.00387	0.00167	0.00171
		5.80	5.95	P-105	0.254	1.867	1.773	2.875	3.063	2.910	20,060	19,650	177,710	0.00339	0.00211	0.00216

Tubing Size		Nominal Weight		Grade	Wall Thick.	Inside Dia.	Threaded & Coupled				Collapse Resistance	Internal Yield Pressure	Joint Yield Strength		Capacity	Displacement	
Nominal	OD	T&C Non-Upset	T&C Upset				Drift Dia.	Coupling Outside Diameter					T&C Non-Upset	T&C Upset		T&C Non-Upset	T&C Upset
In.	In.	lb/ft	lb/ft		In.	In.	In.	Non-Upset	Upset Reg.	Upset Spec.	psi	psi	lb	lb	bb/ft	bb/ft	bb/ft
2 7/8	2.875	6.40	6.50	H-40	0.217	2.441	2.347	3.500	3.668	3.460	5,580	5,280	52,780	72,480	0.00579	0.00233	0.00236
		6.40	6.50	J-55	0.217	2.441	2.347	3.500	3.668	3.460	7,680	7,260	72,580	99,660	0.00579	0.00233	0.00236
		6.40	6.50	C-75	0.217	2.441	2.347	3.500	3.668	3.460	10,470	9,910	98,970	135,900	0.00579	0.00233	0.00236
		8.60	8.70	C-75	0.308	2.259	2.165	3.500	3.668	3.460	14,350	14,060	149,360	185,290	0.00496	0.00313	0.00317
		6.40	6.50	N-80	0.217	2.441	2.347	3.500	3.668	3.460	11,170	10,570	105,570	144,960	0.00579	0.00233	0.00236
		8.60	8.70	N-80	0.308	2.259	2.165	3.500	3.668	3.460	15,300	15,000	159,310	198,710	0.00496	0.00313	0.00317
3 1/2	3.500	6.40	6.50	P-105	0.217	2.441	2.347	3.500	3.668	3.460	14,010	13,870	138,560	190,260	0.00579	0.00233	0.00236
		8.60	8.70	P-105	0.308	2.259	2.165	3.500	3.668	3.460	20,090	19,690	209,100	260,810	0.00496	0.00313	0.00317
		7.70	N/A	H-40	0.216	3.068	2.943	4.250	N/A	N/A	4,630	4,320	65,070	N/A	0.00914	0.00280	N/A
		9.20	9.30	H-40	0.254	2.992	2.867	4.250	4.500	4.180	5,380	5,080	79,540	103,810	0.00870	0.00335	0.00338
		10.20	N/A	H-40	0.289	2.922	2.797	4.250	N/A	N/A	6,060	5,780	92,550	N/A	0.00829	0.00371	N/A
		7.70	N/A	J-55	0.215	3.068	2.943	4.250	N/A	N/A	5,970	5,940	89,470	N/A	0.00914	0.00262	N/A

Tubing Size		Nominal Weight		Grade	Wall Thick.	Inside Dia.	Drift Dia.	Threaded & Coupled			Collapse Resistance	Internal Yield Pressure	Joint Yield Strength		Capacity	Displacement		
Nominal	OD	T&C Non-Upset	T&C Upset					Non-Upset	Upset Reg.	Upset Spec.			T&C Non-Upset	T&C Upset		T&C Non-Upset	T&C Upset	
In.	In.	lb/ft	lb/ft		In.	In.	In.	In.	In.	In.	psi	psi	lb	lb	bb/ft	bb/ft	bb/ft	
3 ½	3.500	9.20	N/A	J-55	0.254	2.992	2.867	4.250	N/A	N/A	N/A	7,400	6,990	127,250	N/A	0.00829	0.00371	N/A
		10.20	N/A	J-55	0.289	2.922	2.797		N/A	N/A	N/A	8,330	7,950	127,250	N/A	0.00829	0.00371	N/A
		7.70	N/A	C-75	0.216	3.068	2.943		N/A	N/A	N/A	7,540	8,100	122,010	N/A	0.00914	0.00280	N/A
		10.20	N/A	C-75	0.289	2.922	2.797		N/A	N/A	N/A	11,360	10,840	173,530	N/A	0.00829	0.00371	N/A
		12.70	12.95	C-75	0.375	2.750	2.625		4.500	4.180	4.180	14,350	14,060	230,990	276,120	0.00735	0.00462	0.00471
		7.70	N/A	N-80	0.216	3.068	2.943		N/A	N/A	N/A	7,870	8,640	130,140	N/A	0.00914	0.00280	N/A
		10.20	N/A	N-80	0.289	2.922	2.797		N/A	N/A	N/A	12,120	11,560	185,100	N/A	0.00829	0.00371	N/A
		12.70	12.95	N-80	0.375	2.750	2.625		4.500	4.180	4.180	15,310	15,000	246,390	294,530	0.00735	0.00462	0.00471
		9.20	9.30	P-105	0.254	2.992	2.867		4.500	4.180	4.180	13,050	13,340	208,800	271,970	0.00870	0.00335	0.00338
		12.70	12.95	P-105	0.375	2.750	2.625		4.500	4.180	4.180	20,090	19,690	323,390	386,570	0.00735	0.00462	0.00471

Tubing Size			Nominal Weight		Grade	Wall Thick.	Inside Dia.	Threaded Coupling				Collapse Resistance	Internal Yield Pressure	Joint Yield Strength		Capacity	Displacement	
Nominal	OD	T&C Non-Upset	T&C Upset	Drift Dia.				Coupling Outside Diameter			T&C Non-Upset			T&C Upset	T&C Non-Upset		T&C Upset	T&C Non-Upset
		In.	lb/ft		In.	lb/ft	In.	Upset Reg.	In.	Upset Spec.		lb	lb			bb/ft		
4	In.	4.000	9.50	H-40	0.226	3.548	3.423	4.750			4,050	3,960	72,000		0.01223	0.00346		
		4.000		H-40	0.262	3.476	3.351		5.000		4,900	4,590		123,070	0.01174		0.00400	
		4.000	9.50	J-55	0.226	3.548	3.423	4.750			5,110	5,440	99,010		0.01223	0.00346		
		4.000		J-55	0.262	3.476	3.351		5.000		6,590	6,300		169,220	0.01174		0.00400	
		4.000	9.50	C-75	0.226	3.548	3.423	4.750			6,350		135,010		0.01223	0.00346		
		4.000		C-75	0.262	3.476	3.351		5.000		8,410	8,600		230,750	0.01174		0.00400	
		4.000	9.50	N-80	0.226	3.548	3.423	4.750			6,590	7,910	144,010		0.01223	0.00346		
		4.000		N-80	0.262	3.476	3.351		5.000		8,800	9,170		246,140	0.01174		0.00400	
4 1/2	In.	4.500	12.60	12.75	H-40	0.271	3.958	3.833	5.200	5.563		4,490	4,220	104,360	144,020	0.01522	0.00458	0.00464
		4.500	12.60	12.75	J-55	0.271	3.958	3.833	5.200	5.563		5,730	5,800	143,500	198,030	0.01522	0.00458	0.00464
		4.500	12.60	12.75	C-75	0.271	3.958	3.833	5.200	5.563		7,200	7,900	195,680	270,040	0.01522	0.00458	0.00464
		4.500	12.60	12.75	N-80	0.271	3.958	3.833	5.200	5.563		7,500	8,430	208,730	288,040	0.01522	0.00458	0.00464

Tubing Size	Connection Data				Tube Data											Capacity		Disp.
	Outer Dia.	Inner Dia.	Make-up Torque	Grade	Outer Dia.	Inner Dia.	Drift	Wall Thick	Cross Section	Yield	Ult. Strength	Depth	Pull	PSI Burst	Collapse	Cap.	Disp.	
	In.	In.	In.		In.	In.				100%		100%	100%	100%	100%	Gals/1000 ft	bbls/ft	
3/4" CS HYDRIL 1.5# P-110	1.327	0.687	300	P-110	1.050	0.742	0.648	0.154	0.433	110,000	125,000	31,700	47,600	32,200	26,200	22.5	15.3	0.00054
1" CS HYDRIL 2.25# C-75	1.600	0.864	400	C-75	1.315	0.957	0.848	0.179	0.639	75,000	95,000	21,300	48,000	20,400	17,600	37.4	34.4	0.00089
1" CS HYDRIL 2.25# N-80/L-80	1.600	0.864	400	N-L-80	1.315	0.957	0.848	0.179	0.639	80,000	100,000	22,600	51,000	21,800	18,800	37.4	34.4	0.00089
1" CS HYDRIL 2.25# T-95	1.600	0.864	400	T-95	1.315	0.957	0.848	0.179	0.639	95,000	105,000	27,000	60,700	25,900	22,300	37.4	34.4	0.00089
1" CS HYDRIL 2.25# P-110	1.600	0.864	400	P-110	1.315	0.957	0.848	0.179	0.639	110,000	125,000	31,200	70,300	29,900	25,900	37.4	34.4	0.00089
1" CS HYDRIL 2.25# S-135	1.600	0.864	500	S-135	1.315	0.957	0.848	0.179	0.639	135,000	145,000	38,300	86,200	36,700	31,700	37.4	34.4	0.00089
1-1/4" CS HYDRIL 3.02# C-75	1.927	1.218	600	C-75	1.660	1.278	1.184	0.191	0.881	75,000	95,000	21,800	66,000	17,200	15,200	66.6	46.2	0.00159
1-1/4" CS HYDRIL 3.02# N-80/L-80	1.927	1.218	600	N-L-80	1.660	1.278	1.184	0.191	0.881	80,000	100,000	23,500	71,000	18,400	16,200	66.6	46.2	0.00159
1-1/4" CS HYDRIL 3.02# T-95	1.927	1.218	600	T-95	1.660	1.278	1.184	0.191	0.881	95,000	105,000	27,700	83,700	21,900	19,300	66.6	46.2	0.00159
1-1/4" CS HYDRIL 3.02# P-110	1.927	1.218	600	P-110	1.660	1.278	1.184	0.191	0.881	110,000	125,000	32,000	96,600	25,300	22,400	66.6	46.2	0.00159
1-1/4" CS HYDRIL 3.02# S-135	1.927	1.218	600	S-135	1.660	1.278	1.184	0.191	0.881	135,000	145,000	39,400	119,000	31,000	27,500	66.6	46.2	0.00159
1-1/2" CS HYDRIL 3.64# N-80/L-80	2.162	1.440	800	N-L-80	1.900	1.500	1.406	0.200	1.068	80,000	100,000	23,300	85,000	16,800	15,000	91.8	55.7	0.00219
1-1/2" CS HYDRIL 3.64# P-110	2.162	1.440	800	P-110	1.900	1.500	1.406	0.200	1.068	110,000	125,000	32,300	117,500	23,000	20,700	91.8	55.7	0.00219
1-1/2" CS HYDRIL 3.64# S-135	2.162	1.440	800	S-135	1.900	1.500	1.406	0.200	1.068	135,000	145,000	39,600	144,199	28,421	25,429	91.8	55.7	0.00219
2-1/4" CS HYDRIL 3.25# N-80/L-80	2.330	1.700	900	N-L-80	2.063	1.751	1.657	0.156	0.935	80,000	100,000	23,000	75,000	12,100	11,200	125.0	49.7	0.00298
2-3/8" EUE 8RD	3.063	1.995	1,500	N-L-80	2.375	1.995	1.901	0.190	1.304	80,000	100,000	22,200	104,300	12,800	11,770	162.3	71.9	0.00386

Tubing Size	Connection Data			Tube Data															
	Outer Dia.	Inner Dia.	Make-up Torque	Grade	Outer Dia.	Inner Dia.	Drift	Wall Thick	Cross Section	Yield	Ult. Strength	Depth	Pull	PSI Burst	Collapse	Cap.	Disp.	Capacity	Disp.
4.7# N-80/L-80																			
2-3/8" PH-6 HYDRIL																			
5.95# N-80/L-80	2.906	1.805	2,200	N-L-80	2.375	1.867	1.773	0.254	1.692	80,000	100,000	22,700	135,000	17,100	15,300	142.2	91.0	0.00339	0.00217
2-3/8" PH-6 HYDRIL																			
5.95# RY-85	2.906	1.805	2,200	RY-85	2.375	1.867	1.773	0.254	1.692	85,000	100,000	24,100	143,800	18,200	16,240	142.2	91.0	0.00339	0.00217
2-3/8" PH-6 HYDRIL																			
5.95# T-95	2.906	1.805	2,200	T-95	2.375	1.867	1.773	0.254	1.692	95,000	110,000	27,000	160,740	19,665	17,595	142.2	91.0	0.00339	0.00217
2-3/8" PH-6 HYDRIL																			
5.95# P-110	2.906	1.805	2,700	P-110	2.375	1.867	1.773	0.254	1.692	105,000	120,000	29,900	178,000	22,500	20,060	142.2	91.0	0.00339	0.00217
2-7/8" EUE 8RD																			
6.5# N-80/L-80	3.668	2.441	2,300	N-L-80	2.875	2.441	2.347	0.217	1.812	80,000	100,000	22,300	145,000	12,100	11,160	243.0	99.5	0.00579	0.00237
2-7/8" PH-6 HYDRIL																			
8.7# N-80/L-80	3.500	2.200	3,000	N-L-80	2.875	2.259	2.165	0.308	2.484	80,000	100,000	22,800	198,700	17,140	15,300	208.1	133.1	0.00495	0.00317
2-7/8" PH-6 HYDRIL																			
7.9# N-80/L-80	3.437	2.265	3,000	N-L-80	2.875	2.323	2.229	0.276	2.254	80,000	100,000	22,800	180,000	15,300	13,900	220.0	120.9	0.00524	0.00288
2-7/8" PH-6 HYDRIL																			
7.9# T-95	3.437	2.265	3,200	T-95	2.875	2.323	2.229	0.276	2.254	95,000	110,000	27,098	214,082	18,000	16,000	220.0	120.9	0.00524	0.00288
2-7/8" PH-6 HYDRIL																			
7.9# P-110	3.437	2.265	3,500	P-110	2.875	2.323	2.229	0.276	2.254	105,000	120,000	29,900	236,000	20,100	18,200	220.0	120.9	0.00524	0.00288
3-1/2" EUE 8RD																			
9.3# N-80/L-80	4.500	2.992	2,400-3,200	N-L-80	3.500	2.992	2.867	0.254	2.590	80,000	100,000	22,200	207,200	11,600	10,700	365.2	134.5	0.00870	0.00320
3-1/2" EUE 8RD																			
9.3# P-110	4.500	2.992	3,000-4,000	P-110	3.500	2.992	2.867	0.254	2.590	110,000	125,000	30,600	284,900	15,900	14,800	365.2	134.5	0.00870	0.00320
3-1/2" PH-6 HYDRIL																			
12.95# N-80/L-80	4.312	2.687	5,500	N-L-80	3.500	2.750	2.625	0.375	3.682	80,000	100,000	22,700	294,500	17,100	15,310	308.4	198.1	0.00734	0.00472
3-1/2" PH-6 HYDRIL																			
12.95# T-95	4.313	2.687	6,000	T-95	3.500	2.750	2.625	0.375	3.682	95,000	105,000	27,000	386,600	20,300	18,100	308.4	198.1	0.00734	0.00472
3-1/2" PH-6 HYDRIL																			
12.95# P-110	4.312	2.687	7,000	P-110	3.500	2.750	2.625	0.375	3.682	105,000	120,000	29,800	386,600	22,500	20,090	308.4	198.1	0.00734	0.00472
4-1/2" PH-6 HYDRIL																			
15.50# P-110	5.125	3.765	8,500	P-110	4.500	3.826	3.701	0.337	4.407	110,000	125,000	31,300	485,000	16,480	14,340	598.0	229.2	0.01424	0.00546

Casing OD (in.)	Weight (ppf)	Burst Pressure (psi)					Collapse Pressure (psi)						
		H40	J/K 55	C75	N80	C95	P110	H40	J/K 55	C75	N80	C95	P110
4 1/2	9.5		4,380						3,310				
	11.6		5,350	7,290	7,780	9,240	10,690		4,960	6,100	6,350	7,030	7,580
	13.5		6,200	8,460	9,020	10,710	12,410		6,420	8,140	8,540	9,660	10,680
	15.1		7,210	9,830	10,480		14,420		7,620	10,390	11,080		14,350
5	11.5		4,240						3,060				
	13.0		4,870	6,640	7,090				4,140	4,990	5,140		
	15.0		5,700	7,770	8,290	9,840	11,400		5,500	6,970	7,250	8,090	8,830
	18.0		6,970	9,500	10,140	12,040	13,940		7,390	10,000	10,490	12,010	13,470
5 1/2	14.0		4,270	5,820					3,120	3,560			
	15.5		4,810	6,560	7,000		9,620		3,860	4,860	4,990		5,620
	17.0		5,320	7,250	7,740	9,190	10,640		4,910	6,070	5,890	6,930	8,520
	20.0		6,310	8,610	9,190	10,910	12,640		6,610	8,440	8,830	10,000	11,100
6 5/8	23.0		7,270	9,900	10,560	12,540	14,520		7,670	10,400	11,160	12,920	14,520
	20.0		4,180		6,090	7,230			3,060		3,480	3,830	
	24.0		5,110	6,970	7,440	8,830	10,230		4,560	5,550	5,550	6,310	6,730
	28.0		6,060	8,260	8,810	10,460	12,120		6,170	7,830	8,170	9,200	10,140
7	20.0	2,720	3,740	5,100				1,920	2,500	2,660			
	23.0		4,360	5,940	6,340	7,530			3,270	3,770	3,830	4,150	
	26.0		4,980	6,790	7,240	8,600	9,960		4,320	5,250	5,320	5,870	7,220
	29.0		5,610	7,650	8,160	9,690	11,220		5,400	6,760	7,020	7,820	8,510
7	32.0		6,230	8,490	9,060	10,760	12,460		6,460	8,230	8,600	9,730	10,760
	35.0		6,850	9,340	9,960	11,830	13,700		7,270	9,710	10,180	11,640	13,020

Casing OD (in.)	Weight (ppf)	Burst Pressure (psi)						Collapse Pressure (psi)					
		H40	J/K 55	C75	N80	C95	P110	H40	J/K 55	C75	N80	C95	P110
7 ⁵ / ₈	26.4		4,140	5,650	6,020	7,150	8,280		3,010	3,280	3,930	3,710	3,900
	29.7			6,450	6,890	8,180	9,470			4,670	4,790	5,120	6,180
	33.7		5,430	7,400	7,900	8,180	10,860		5,090	6,320	6,560	7,260	7,870
	39.0			8,610	9,180	9,380	12,620			8,430	8,820	9,980	11,060
	24.0		2,950						950				
8 ⁵ / ₈	32.0	2,860	3,930	5,360	5,710	7,860		2,210	2,530	2,950	3,050		3,430
	36.0		4,460	6,090	6,490	7,710	8,930		3,450	4,020	4,470	4,360	4,700
	40.0		5,020	6,850	7,300	8,670	10,040		4,400	5,350	5,520	6,010	7,420
	36.0	2,560	3,520	4,800	5,120		7,040	1,710	2,220	2,320	2,370		2,470
9 ⁵ / ₈	40.0		3,950	5,390	5,750	6,820	7,900		2,570	2,980	3,530	3,330	3,480
	43.5		4,350	5,930	6,330	7,510	8,700		3,250	3,750	3,810	4,130	4,760
	47.0		4,720	6,440	6,870	8,150	9,440		3,880	4,630	4,760	5,080	5,310
	53.5			7,430	7,930	9,410	10,900			6,380	6,620	7,330	7,930
	40.5	2,280	3,130	4,270				1,420	1,730	1,720			
10 ³ / ₄	45.5		3,580	4,880	5,210	7,160			2,090	2,410	2,480		2,610
	51.0		4,030	5,490	5,860	6,960	8,060		2,700	3,100	3,750	3,490	3,750
	55.5		4,430	6,040	6,450	7,660	8,860		3,320	3,950	4,020	4,300	4,630
	60.7		4,880	6,650	7,100	8,436	9,760		4,160	5,020	5,160	5,566	5,860
	65.7		5,330	7,260	7,750	9,200	10,650		4,920	6,080	6,300	6,950	7,490
11 ³ / ₄	71.1					10,050	11,640					8,470	9,280
	47.0		3,070	4,190					1,630	1,620			
	54.0		3,560	4,860					2,070	2,380			
	60.0		4,010	5,460	5,830	6,920	8,010		2,660	3,070	3,680	3,440	3,610

Casing OD (in.)	Weight (ppf)	Burst Pressure (psi)						Collapse Pressure (psi)					
		H40	J/K 55	C75	N80	C95	P110	H40	J/K 55	C75	N80	C95	P110
13 3/8	48.0	1,730						770					
	54.5		2,730	3,980	5,470				1,140				
	61.0		3,090	4,220	4,500				1,540	1,660	1,670		
	68.0		3,450	4,710	5,020	5,970			1,950	2,220	2,270	2,330	
	72.0		3,700	5,040	5,380	6,390	7,400		2,230	2,590	2,880	2,820	2,880
	77.0			5,400	5,760					2,990	3,100		
	85.0			5,970	6,360	8,750				3,810	3,870	4,490	
16	65.0	1,640						670					
	75.0		2,630						1,010				
	84.0		2,980						1,410				
	109.0		3,950				7,890		2,560				3,470
18 5/8	87.5	1,530	2,110					520	520				
	106.0		2,740						1,140				
20	94.0	1,530	2,110					520	520				
	106.5		2,410						770				
	133.0		3,060						1,500				
24	156.0	X-42	1,910					860					
26	202.0	X-42	2,120					1,100					
30	310.0	X-42	2,450					1,480					
36	374.0	X-42	2,040					1,010					

Casing Capacity

Casing OD (In.)	Weight (ppf)	Casing ID (In.)	Capacity (bbl/ft)	Displacement (bbl/ft)
4 ½	9.5	4.090	0.0163	0.0035
	11.6	4.000	0.0155	0.0042
	13.5	3.920	0.0149	0.0049
	15.1	3.826	0.0142	0.0055
5	11.5	4.560	0.0202	0.0042
	13.0	4.494	0.0196	0.0047
	15.0	4.408	0.0189	0.0055
	18.0	4.276	0.0178	0.0066
5 ½	14.0	5.012	0.0244	0.0051
	15.5	4.950	0.0238	0.0056
	17.0	4.892	0.0233	0.0062
	20.0	4.778	0.0222	0.0073
	23.0	4.670	0.0212	0.0084
6 ⅝	20.0	6.049	0.0355	0.0071
	24.0	5.921	0.0341	0.0087
	28.0	5.791	0.0326	0.0102
7	20.0	6.456	0.0405	0.0073
	23.0	6.366	0.0394	0.0084
	26.0	6.276	0.0383	0.0095
	29.0	6.184	0.0372	0.0106
	32.0	6.094	0.0361	0.0116
	35.0	6.004	0.0350	0.0127
7 ⅝	26.4	6.969	0.0472	0.0096
	29.7	6.875	0.0459	0.0108
	33.7	6.765	0.0445	0.0123
	39.0	6.624	0.0426	0.0142
8 ⅝	24.0	8.098	0.0637	0.0086
	32.0	7.921	0.0610	0.0116
	36.0	7.825	0.0595	0.0131
	40.0	7.725	0.0580	0.0146
9 ⅝	36.0	8.921	0.0773	0.0131
	40.0	8.835	0.0758	0.0146
	43.5	8.755	0.0745	0.0158
	47.0	8.681	0.0732	0.0171
	53.5	8.535	0.0708	0.0195

Casing Capacity

Casing OD (In.)	Weight (ppf)	Casing ID (In.)	Capacity (bbl/ft)	Displacement (bbl/ft)
10 ¾	40.5	10.050	0.0981	0.0147
	45.5	9.950	0.0962	0.0166
	51.0	9.850	0.0943	0.0186
	55.5	9.760	0.0925	0.0202
	60.7	9.660	0.0907	0.0216
	65.7	9.560	0.0888	0.0235
	71.1	9.450	0.0868	0.0255
	76.0	9.350	0.0849	0.0273
	81.0	9.250	0.0831	0.0291
11 ¾	47.0	11.000	0.1175	0.0171
	54.0	10.880	0.1150	0.0197
	60.0	10.772	0.1127	0.0218
13 ¾	48.0	12.715	0.1571	0.0175
	54.5	12.615	0.1546	0.0198
	61.0	12.515	0.1522	0.0219
	68.0	12.415	0.1497	0.0247
	72.0	12.347	0.1481	0.0262
	77.0	12.275	0.1464	0.0274
	85.0	12.159	0.1436	0.0302
16	65.0	15.250	0.2259	0.0237
	75.0	15.124	0.2222	0.0273
	84.0	15.010	0.2189	0.0306
	109.0	14.688	0.2096	0.0391
	118.0	14.570	0.2062	0.0425
18 5/8	87.5	17.755	0.3062	0.0307
	109.0	17.491	0.2972	0.0398
	122.0	17.385	0.2936	0.0434
20	94.0	19.124	0.3553	0.0342
	106.5	19.000	0.3507	0.0388
	133.0	18.730	0.3408	0.0484
24 x 5/8" t _{in}	156.0	22.750	0.5028	0.0568
30 x 1" t _{in}	310.0	28.000	0.7616	0.1127
36 x 1" t _{in}	374.0	34.000	1.1230	0.1360
48 x 1" t _{in}	502.0	46.000	2.0556	0.1826

Note: To find casing weight for other wall thicknesses:

$$\text{Weight of Casing}_{\text{lb/ft}} = 10.68 \times (\text{OD}_{\text{in}} - t_{\text{in}}) \times t_{\text{in}}$$

Where:

t_{in} = Wall thickness (inches)

Hole Capacity

Hole Diameter (In.)	Hole Capacity (bbl/ft)		Hole Diameter (In.)	Hole Capacity (bbl/ft)
3	0.0087		23	0.5139
3 ½	0.0119		23 ½	0.5365
4	0.0155		24	0.5595
4 ½	0.0197		24 ½	0.5831
5	0.0243		25	0.6071
5 ½	0.0294		25 ½	0.6317
6	0.0350		26	0.6567
6 ½	0.0410		26 ½	0.6822
7	0.0476		27	0.7082
7 ½	0.0546		27 ½	0.7347
8	0.0622		28	0.7616
8 ½	0.0702		28 ½	0.7891
9	0.0787		29	0.8170
9 ½	0.0877		29 ½	0.8454
10	0.0971		30	0.8743
10 ½	0.1071		30 ½	0.9037
11	0.1175		31	0.9336
11 ½	0.1285		31 ½	0.9639
12	0.1399		32	0.9948
12 ½	0.1518		32 ½	1.0261
13	0.1642		33	1.0579
13 ½	0.1770		33 ½	1.0902
14	0.1904		34	1.1230
14 ½	0.2042		34 ½	1.1563
15	0.2086		35	1.1900
15 ½	0.2334		35 ½	1.2243
16	0.2487		36	1.2590
16 ½	0.2645		36 ½	1.2942
17	0.2807		37	1.3299
17 ½	0.2975		37 ½	1.3661
18	0.3147		38	1.4028
18 ½	0.3325		38 ½	1.4399
19	0.3507		39	1.4776
19 ½	0.3694		39 ½	1.5157
20	0.3886		40	1.5543
20 ½	0.4082		40 ½	1.5934
21	0.4284		41	1.6330
21 ½	0.4490		41 ½	1.6731
22	0.4702		42	1.7136
22 ½	0.4918		42 ½	1.7547

Liner Diameter	STROKE LENGTH (INCHES)															Units
	2	2 ½	3	4	5	6	7	7 ½	8	8 ½	9	9 ½	10	11	12	
1"	0.0005	0.0006	0.0007	0.0010	0.0012	0.0015	0.0017	0.0018	0.0019	0.0021	0.0022	0.0023	0.0024	0.0027	0.0029	BBLs/STK
	0.0204	0.0255	0.0306	0.0408	0.0510	0.0612	0.0714	0.0765	0.0816	0.0868	0.0919	0.0970	0.1021	0.1123	0.1225	Gal/STK
1 ⅝"	0.0009	0.0011	0.0014	0.0018	0.0023	0.0028	0.0032	0.0034	0.0037	0.0039	0.0041	0.0044	0.0046	0.0051	0.0055	BBLs/STK
	0.0386	0.0482	0.0579	0.0772	0.0965	0.1158	0.1351	0.1447	0.1544	0.1640	0.1737	0.1833	0.1930	0.2123	0.2315	Gal/STK
1 ½"	0.0011	0.0014	0.0016	0.0022	0.0027	0.0033	0.0038	0.0041	0.0044	0.0046	0.0049	0.0052	0.0055	0.0060	0.0066	BBLs/STK
	0.0459	0.0574	0.0689	0.0919	0.1148	0.1378	0.1607	0.1722	0.1837	0.1952	0.2067	0.2182	0.2296	0.2526	0.2756	Gal/STK
1 ⅞"	0.0013	0.0016	0.0019	0.0026	0.0032	0.0039	0.0045	0.0048	0.0051	0.0055	0.0058	0.0061	0.0064	0.0071	0.0077	BBLs/STK
	0.0539	0.0674	0.0809	0.1078	0.1348	0.1617	0.1887	0.2021	0.2156	0.2291	0.2426	0.2560	0.2695	0.2965	0.3234	Gal/STK
1 ¾"	0.0015	0.0019	0.0022	0.0030	0.0037	0.0045	0.0052	0.0056	0.0060	0.0063	0.0067	0.0071	0.0074	0.0082	0.0089	BBLs/STK
	0.0625	0.0781	0.0938	0.1250	0.1563	0.1875	0.2188	0.2344	0.2500	0.2657	0.2813	0.2969	0.3126	0.3438	0.3751	Gal/STK
2"	0.0019	0.0024	0.0029	0.0039	0.0049	0.0058	0.0068	0.0073	0.0078	0.0083	0.0087	0.0092	0.0097	0.0107	0.0117	BBLs/STK
	0.0816	0.1021	0.1225	0.1633	0.2041	0.2449	0.2858	0.3062	0.3266	0.3470	0.3674	0.3878	0.4082	0.4491	0.4899	Gal/STK
2 ¼"	0.0025	0.0031	0.0037	0.0049	0.0062	0.0074	0.0086	0.0092	0.0098	0.0105	0.0111	0.0117	0.0123	0.0135	0.0148	BBLs/STK
	0.1033	0.1292	0.1550	0.2067	0.2583	0.3100	0.3617	0.3875	0.4133	0.4392	0.4650	0.4908	0.5167	0.5683	0.6200	Gal/STK
2 ½"	0.0030	0.0038	0.0046	0.0061	0.0076	0.0091	0.0106	0.0114	0.0122	0.0129	0.0137	0.0144	0.0152	0.0167	0.0182	BBLs/STK
	0.1276	0.1595	0.1914	0.2552	0.3189	0.3827	0.4465	0.4784	0.5103	0.5422	0.5741	0.6060	0.6379	0.7017	0.7655	Gal/STK
2 ¾"	0.0037	0.0046	0.0055	0.0074	0.0092	0.0110	0.0129	0.0138	0.0147	0.0156	0.0165	0.0175	0.0184	0.0202	0.0221	BBLs/STK
	0.1544	0.1930	0.2315	0.3087	0.3859	0.4631	0.5403	0.5789	0.6175	0.6561	0.6946	0.7332	0.7718	0.8490	0.9262	Gal/STK
3"	0.0044	0.0055	0.0066	0.0087	0.0109	0.0131	0.0153	0.0164	0.0175	0.0186	0.0197	0.0208	0.0219	0.0241	0.0262	BBLs/STK
	0.1837	0.2296	0.2756	0.3674	0.4593	0.5511	0.6430	0.6889	0.7348	0.7808	0.8267	0.8726	0.9185	1.0104	1.1022	Gal/STK
3 ¼"	0.0051	0.0064	0.0077	0.0103	0.0128	0.0154	0.0180	0.0193	0.0205	0.0218	0.0231	0.0244	0.0257	0.0282	0.0308	BBLs/STK
	0.2156	0.2695	0.3234	0.4312	0.5390	0.6468	0.7546	0.8085	0.8624	0.9163	0.9702	1.0241	1.0780	1.1858	1.2936	Gal/STK
3 ½"	0.0060	0.0074	0.0089	0.0119	0.0149	0.0179	0.0208	0.0223	0.0238	0.0253	0.0268	0.0283	0.0298	0.0327	0.0357	BBLs/STK
	0.2500	0.3126	0.3751	0.5001	0.6251	0.7501	0.8752	0.9377	1.0002	1.0627	1.1252	1.1877	1.2502	1.3753	1.5003	Gal/STK
3 ¾"	0.0068	0.0085	0.0103	0.0137	0.0171	0.0205	0.0239	0.0256	0.0273	0.0290	0.0308	0.0325	0.0342	0.0376	0.0410	BBLs/STK
	0.2870	0.3588	0.4306	0.5741	0.7176	0.8611	1.0047	1.0764	1.1482	1.2199	1.2917	1.3635	1.4352	1.5787	1.7223	Gal/STK

Liner Diameter	STROKE LENGTH (INCHES)															Units	
	2	2 ½	3	4	5	6	7	7 ½	8	8 ½	9	9 ½	10	11	12		
4"	0.0078	0.0097	0.0117	0.0156	0.0194	0.0233	0.0272	0.0292	0.0311	0.0330	0.0350	0.0369	0.0389	0.0428	0.0467	BBLs/STK	
	0.3266	0.4082	0.4899	0.6532	0.8165	0.9798	1.1431	1.2247	1.3064	1.3880	1.4697	1.5513	1.6330	1.7963	1.9596	Gal/STK	
4 ¼"	0.0088	0.0110	0.0132	0.0176	0.0219	0.0263	0.0307	0.0329	0.0351	0.0373	0.0395	0.0417	0.0439	0.0483	0.0527	BBLs/STK	
	0.3687	0.4609	0.5530	0.7374	0.9217	1.1061	1.2907	1.3826	1.4748	1.5669	1.6591	1.7513	1.8435	2.0278	2.2122	Gal/STK	
4 ½"	0.0098	0.0123	0.0148	0.0197	0.0246	0.0295	0.0344	0.0369	0.0394	0.0418	0.0443	0.0467	0.0492	0.0541	0.0590	BBLs/STK	
	0.4133	0.5167	0.6200	0.8267	1.0334	1.2400	1.4467	1.5500	1.6534	1.7567	1.8600	1.9634	2.0667	2.2734	2.4801	Gal/STK	
4 ¾"	0.0110	0.0137	0.0164	0.0219	0.0274	0.0329	0.0384	0.0411	0.0439	0.0466	0.0493	0.0521	0.0548	0.0603	0.0658	BBLs/STK	
	0.4605	0.5757	0.6908	0.9211	1.1514	1.3816	1.6119	1.7270	1.8422	1.9573	2.0725	2.1876	2.3027	2.5330	2.7633	Gal/STK	
5"	0.0122	0.0152	0.0182	0.0243	0.0304	0.0365	0.0425	0.0456	0.0486	0.0516	0.0547	0.0577	0.0608	0.0668	0.0729	BBLs/STK	
	0.5103	0.6379	0.7655	1.0206	1.2758	1.5309	1.7861	1.9136	2.0412	2.1688	2.2964	2.4239	2.5515	2.8067	3.0618	Gal/STK	
5 ¼"	0.0134	0.0167	0.0201	0.0268	0.0335	0.0402	0.0469	0.0502	0.0536	0.0569	0.0603	0.0636	0.0670	0.0737	0.0804	BBLs/STK	
	0.5626	0.7033	0.8439	1.1252	1.4065	1.6878	1.9691	2.1098	2.2504	2.3911	2.5317	2.6724	2.8130	3.0943	3.3756	Gal/STK	
5 ½"	0.0147	0.0184	0.0221	0.0294	0.0368	0.0441	0.0515	0.0551	0.0588	0.0625	0.0662	0.0698	0.0735	0.0809	0.0882	BBLs/STK	
	0.6175	0.7718	0.9262	1.2349	1.5437	1.8524	2.1611	2.3155	2.4699	2.6242	2.7786	2.9329	3.0873	3.3960	3.7048	Gal/STK	
5 ¾"	0.0161	0.0201	0.0241	0.0321	0.0402	0.0482	0.0562	0.0603	0.0643	0.0683	0.0723	0.0763	0.0803	0.0884	0.0964	BBLs/STK	
	0.6749	0.8436	1.0123	1.3497	1.6872	2.0246	2.3621	2.5308	2.6995	2.8682	3.0369	3.2056	3.3744	3.7118	4.0492	Gal/STK	
6"	0.0175	0.0219	0.0262	0.0350	0.0437	0.0525	0.0612	0.0656	0.0700	0.0744	0.0787	0.0831	0.0875	0.0962	0.1050	BBLs/STK	
	0.7348	0.9185	1.1022	1.4697	1.8372	2.2045	2.5719	2.7556	2.9393	3.1230	3.3067	3.4905	3.6742	4.0416	4.4090	Gal/STK	
6 ¼"	0.0190	0.0237	0.0285	0.0380	0.0475	0.0570	0.0664	0.0712	0.0759	0.0807	0.0854	0.0902	0.0949	0.1044	0.1139	BBLs/STK	
	0.7973	0.9967	1.1960	1.5947	1.9934	2.3920	2.7907	2.9900	3.1894	3.3887	3.5880	3.7874	3.9867	4.3854	4.7841	Gal/STK	
6 ½"	0.0205	0.0257	0.0308	0.0411	0.0513	0.0616	0.0719	0.0770	0.0821	0.0873	0.0924	0.0975	0.1027	0.1129	0.1232	BBLs/STK	
	0.8624	1.0780	1.2936	1.7248	2.1560	2.5872	3.0184	3.2340	3.4496	3.6652	3.8808	4.0964	4.3120	4.7432	5.1744	Gal/STK	
6 ¾"	0.0221	0.0277	0.0332	0.0443	0.0554	0.0664	0.0775	0.0830	0.0886	0.0941	0.0996	0.1052	0.1107	0.1218	0.1329	BBLs/STK	
	0.9300	1.1625	1.3950	1.8600	2.3251	2.7901	3.2551	3.4876	3.7201	3.9526	4.1851	4.4176	4.6501	5.1151	5.5801	Gal/STK	
7"	0.0238	0.0298	0.0357	0.0476	0.0595	0.0714	0.0833	0.0893	0.0953	0.1012	0.1072	0.1131	0.1191	0.1310	0.1429	BBLs/STK	
	1.0002	1.2502	1.5003	2.0004	2.5005	3.0006	3.5007	3.7507	4.008	4.2508	4.5008	4.7509	5.0009	5.5010	6.0011	Gal/STK	

Initial Mud Wt (ppg)	DESIRED MUD WEIGHT (PPG)																		Dilution or Cut Back: The gray section of the chart shows the number of water which must be added to 100 bbls of mud to produce the desired weight reduction.	Mud Weight Increase: The yellow section of the chart indicates the number of 100 lb sacks of barite which must be added to 100 bbls of mud to produce desired weight increases.																	
	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5	15.0	15.5	16.0	16.5	17.0	17.5	18.0																			
9.0	29	59	90	123	156	192	229	268	308	350	395	442	490	542	596	653	714	778																			
9.5		29	60	92	125	160	196	234	273	315	359	405	452	503	557	612	672	735																			
10.0	43		30	61	93	128	164	201	239	280	323	368	414	464	516	571	630	691																			
10.5	85	30		31	62	96	131	167	205	245	287	331	376	426	479	531	588	648																			
11.0	128	60	23		31	64	98	134	171	210	251	294	339	387	437	490	546	605																			
11.5	171	90	46	19		32	66	101	137	175	215	258	301	348	397	449	504	562																			
12.0	214	120	69	37	16		33	67	103	140	179	221	263	310	357	408	462	518																			
12.5	256	150	92	56	32	14		34	68	105	144	184	226	271	318	367	420	475																			
13.0	299	180	115	75	48	27	12		34	70	108	147	188	232	278	327	378	432																			
13.5	342	210	138	94	63	41	24	11		35	72	111	150	194	238	286	336	389																			
14.0	385	240	161	112	76	54	36	21	10		36	74	113	155	199	245	294	345																			
14.5	427	270	185	131	95	68	48	32	19	9		37	75	116	159	204	252	302																			
15.0	470	300	208	150	110	82	60	43	29	18	8		37	77	119	163	210	259																			
15.5	513	330	231	169	126	95	72	54	39	26	16	8		39	79	122	168	216																			
16.0	556	360	254	187	142	109	84	64	48	35	24	15	7		40	81	126	172																			
16.5	598	390	277	206	158	123	96	75	58	44	32	23	14	7		41	84	129																			
17.0	641	420	300	225	174	136	108	86	68	53	40	30	21	13	6		42	86																			
17.5	684	450	323	244	189	150	120	96	77	62	49	38	28	20	12	6		43																			
18.0	726	480	346	262	205	163	132	107	87	71	57	45	35	26	18	12	5																				
Dilution or Cut Back: The gray section of the chart shows the number of barrels of water which must be added to 100 bbls of mud to produce the desired weight reduction.																			Mud Weight Increase: The yellow section of the chart indicates the number of 100 lb sacks of barite which must be added to 100 bbls of mud to produce desired weight increases.																		

Mud Weights

lb/gal	lb/ft ³	kg/m ³	Specific Gravity	Gradient Depth (psi/ft)	Gradient Depth (kPa/m)
8.34	62.38	999.3	1.00	0.434	9.8
8.5	63.58	1018.5	1.02	0.442	10.0
8.6	64.32	1030.5	1.03	0.447	10.1
8.7	65.07	1042.4	1.04	0.452	10.2
8.8	65.82	1054.4	1.05	0.458	10.4
8.9	66.57	1066.4	1.07	0.463	10.5
9.0	67.31	1078.4	1.08	0.468	10.6
9.1	68.06	1090.4	1.09	0.473	10.7
9.2	68.81	1102.3	1.10	0.478	10.8
9.3	69.56	1114.3	1.12	0.484	10.9
9.4	70.31	1126.3	1.13	0.489	11.1
9.5	71.05	1138.3	1.14	0.494	11.2
9.6	71.80	1150.3	1.15	0.499	11.3
9.7	72.55	1162.3	1.16	0.504	11.4
9.8	73.30	1174.2	1.18	0.510	11.5
9.9	74.05	1186.2	1.19	0.515	11.6
10.0	74.79	1198.2	1.20	0.520	11.8
10.1	75.54	1210.2	1.21	0.525	11.9
10.2	76.29	1222.2	1.22	0.530	12.0
10.3	77.04	1234.2	1.24	0.536	12.1
10.4	77.79	1246.1	1.25	0.541	12.2
10.5	78.53	1258.1	1.26	0.546	12.4
10.6	79.28	1270.1	1.27	0.551	12.5
10.7	80.03	1282.1	1.28	0.556	12.6
10.8	80.78	1294.1	1.29	0.562	12.7
10.9	81.53	1306.0	1.31	0.567	12.8
11.0	82.27	1318.0	1.32	0.572	12.9
11.1	83.02	1330.0	1.33	0.577	13.1
11.2	83.77	1342.0	1.34	0.582	13.2
11.3	84.52	1354.0	1.36	0.588	13.3
11.4	85.27	1366.0	1.37	0.593	13.4
11.5	86.01	1377.9	1.38	0.598	13.5
11.6	86.76	1389.9	1.39	0.603	13.6
11.7	87.51	1401.9	1.40	0.608	13.8
11.8	88.26	1413.9	1.41	0.614	13.9
11.9	89.01	1425.9	1.43	0.619	14.0
12.0	89.75	1437.8	1.44	0.624	14.1
12.1	90.50	1449.8	1.45	0.629	14.2
12.2	91.25	1461.8	1.46	0.634	14.4
12.3	92.00	1473.8	1.48	0.640	14.5
12.4	92.74	1485.8	1.49	0.645	14.6
12.5	93.49	1497.8	1.50	0.650	14.7
12.6	94.24	1509.7	1.51	0.655	14.8
12.7	94.99	1521.7	1.52	0.660	14.9
12.8	95.74	1533.7	1.53	0.666	15.1
12.9	96.48	1545.7	1.55	0.671	15.2
13.0	97.23	1557.7	1.56	0.676	15.3
13.1	97.98	1569.6	1.57	0.681	15.4
13.2	98.73	1581.6	1.58	0.686	15.5

Mud Weights

lb/gal	lb/ft ³	kg/m ³	Specific Gravity	Gradient Depth (psi/ft)	Gradient Depth (kPa/m)
13.3	99.48	1593.6	1.60	0.692	15.6
13.4	100.22	1605.6	1.61	0.697	15.8
13.5	100.97	1617.6	1.62	0.702	15.9
13.6	101.72	1629.6	1.63	0.707	16.0
13.7	102.47	1641.5	1.64	0.712	16.1
13.8	103.22	1653.5	1.65	0.718	16.2
13.9	103.96	1665.5	1.67	0.723	16.4
14.0	104.71	1677.5	1.68	0.728	16.5
14.1	105.46	1689.5	1.69	0.733	16.6
14.2	106.21	1701.5	1.70	0.738	16.7
14.3	106.96	1713.4	1.72	0.744	16.8
14.4	107.70	1725.4	1.73	0.749	16.9
14.5	108.45	1737.4	1.74	0.754	17.1
14.6	109.20	1749.4	1.75	0.759	17.2
14.7	109.95	1761.4	1.76	0.764	17.3
14.8	110.70	1773.3	1.78	0.770	17.4
14.9	111.44	1785.3	1.79	0.775	17.5
15.0	112.19	1797.3	1.80	0.780	17.6
15.1	112.94	1809.3	1.81	0.785	17.8
15.2	113.69	1821.3	1.82	0.790	17.9
15.3	114.44	1833.3	1.84	0.796	18.0
15.4	115.18	1845.2	1.85	0.801	18.1
15.5	115.93	1857.2	1.86	0.806	18.2
15.6	116.68	1869.2	1.87	0.811	18.3
15.7	117.43	1881.2	1.88	0.816	18.5
15.8	118.18	1893.2	1.90	0.822	18.6
15.9	118.92	1905.1	1.91	0.827	18.7
16.0	119.67	1917.1	1.92	0.832	18.8
16.1	120.42	1929.1	1.93	0.837	18.9
16.2	121.17	1941.1	1.94	0.842	19.1
16.3	121.91	1953.1	1.96	0.846	19.2
16.4	122.66	1965.1	1.97	0.853	19.3
16.5	123.41	1977.0	1.98	0.858	19.4
16.6	124.16	1989.0	2.00	0.863	19.5
16.7	124.91	2001.0	2.01	0.868	19.6
16.8	125.65	2013.0	2.02	0.874	19.8
16.9	126.40	2025.0	2.03	0.879	19.9
17.0	127.15	2036.9	2.04	0.884	20.0
17.1	127.90	2048.9	2.05	0.889	20.1
17.2	128.65	2060.9	2.06	0.894	20.2
17.3	129.39	2072.9	2.08	0.900	20.3
17.4	130.14	2084.9	2.09	0.905	20.5
17.5	130.89	2096.9	2.10	0.910	20.6
17.6	131.64	2108.8	2.11	0.915	20.7
17.7	132.39	2120.8	2.12	0.920	20.8
17.8	133.13	2132.8	2.14	0.926	20.9
17.9	133.88	2144.8	2.15	0.931	21.1
18.0	134.63	2156.8	2.16	0.936	21.2
18.1	135.38	2168.8	2.17	0.941	21.3

Mud Weights

lb/gal	lb/ft ³	kg/m ³	Specific Gravity	Gradient Depth (psi/ft)	Gradient Depth (kPa/m)
18.2	136.13	2180.7	2.18	0.946	21.4
18.3	136.87	2192.7	2.20	0.952	21.5
18.4	137.62	2204.7	2.21	0.957	21.6
18.5	138.37	2216.7	2.22	0.962	21.8
18.6	139.12	2228.7	2.23	0.967	21.9
18.7	139.87	2240.6	2.24	0.972	22.0
18.8	140.61	2252.6	2.26	0.978	22.1
18.9	141.36	2264.6	2.27	0.983	22.2
19.0	142.11	2276.6	2.28	0.988	22.3
19.1	142.86	2288.6	2.29	0.993	22.5
19.2	143.61	2300.6	2.30	0.998	22.6
19.3	144.35	2312.5	2.32	1.004	22.7
19.4	145.10	2324.5	2.33	1.009	22.8
19.5	145.85	2336.5	2.34	1.014	22.9
19.6	146.60	2348.5	2.35	1.019	23.1
19.7	147.34	2360.5	2.36	1.024	23.2
19.8	148.09	2372.4	2.38	1.030	23.3
19.9	148.84	2384.4	2.39	1.035	23.4
20.0	149.59	2396.4	2.40	1.040	23.5

Specifications for BOP Flanges, Ring Gaskets, and Flange Bolts & Nuts

Stack Rating	Approved Flanges	Approved Ring Gaskets	Bolt Spec.	Nut Spec.
2000 psi and 3000 psi	API type 6B with type R flat Bottom Groove	API Type RX	ASTM Grade B-7	ASTM Grade 2-H
5000 psi	API Type 6B with Type R Flat Bottom groove or API Type 6BX with Type BX Groove	API Type RX or API Type BX with Type 6BX Flange	ASTM Grade B-7	ASTM Grade 2-H
10,000 psi	API Type 6BX with Type BX Groove	API Type BX	ASTM Grade B-7	ASTM Grade 2-H

Bolt Size (In.)	Torque (Ft-Lb)
¾ - 10 UNC	200
⅞ - 9 UNC	325
1 - 8 UNC	475
1 ⅛ - 8 UN	600
1 ½ - 8 UN	1400
1 ⅝ - 8 UN	1700
1 ¾ - 8 UN	2040
1 ⅞ - 8 UN	3220

NOTE: Acceptable flange ring gasket material for sweet oil applications is low-carbon steel and for sour oil or gas is type 316 stainless or type 304 stainless steel. ASTM A-193 Grade B/M with a maximum Rockwell Hardness of 22 may be acceptable but should be derated as per Table 1.4B of API Spec 6A. Specifications as per API Spec 6A "Wellhead Equipment".

Gate Valve Data

Size, Working Pressure and Number of Turns to Operate						
Cameron				W-K-M		
Cameron valves have a round handwheel with the name "Cameron" embossed on it. Operate Cameron Valves full open or full close, then back off ¼ turn.				W-K-M valves have a unique wedge shaped handwheel. Operate W-K-M valves full open or full close, then jam tight .		
3,000/5,000 psi WP				3,000/5,000 psi WP		
Model	Inches	Turns		Model	Inches	Turns
F, FC & FL	2 1/16	12 1/2		M	2 1/16	13
	2 9/16	15 1/4			2 9/16	16
	3 1/8	18 1/4			3 1/8	20
	4 1/16	23 1/2			4 1/16	25
10,000 psi WP				10,000 - 15,000 psi WP		
FC, FL & FLS	1 13/16	12 1/2		M-1 & M-2	1 13/16	14
	2 1/16	12 1/2			2 1/16	12
	2 9/16	15 1/4			2 9/16	15
	3 1/16	18 1/4			3 1/16	17 1/2
	4 1/16	23 1/2			4 1/16	23
15,000 – 20,000 psi WP				20,000 psi WP		
FLS	1 13/16	12 1/2		M-3	1 13/16	15
	2 1/16	12 1/2			2 1/16	16 1/2
	2 9/16	15 3/4			2 9/16	19 1/2
	3 1/16	22 7/8			3 1/16	23
	4 1/16	29 1/2			4 1/16	29
15,000 – 20,000 psi WP						
F, FC & FL	1 13/16	12 1/2				
	2 1/16	12 1/2				
	2 9/16	15 3/4				
	3 1/16	15 1/4				
	4 1/16	29 1/2				
10,000 psi WP						
J & JS	1 13/16	12				
	2 1/16	12				
	2 9/16	17 1/4				
	3 1/16	21 1/2				
	4 1/16	23				
15,000 psi WP						
J & JS	1 13/16	15 3/4				
	2 1/16	15 3/4				
	2 9/16	19 1/2				
	3 1/16	135	Torque Multiplier			
20,000 psi WP						
J & JS	1 13/16	15 3/4				
	2 1/16	15 3/4				
	2 9/16	117	Torque Multiplier			
	3 1/16	135	Torque Multiplier			

Size, Working Pressure and Number of Turns to Operate

Ingram Cactus			McEvoy		
Ingram Cactus valves have a round handwheel with three spokes and the name "Ingram Cactus" embossed on it. Operate Ingram Cactus valves Model 205 and 215 full open or full close, then jam tight . Operate Model 405 and 315 full open or full close, then back off ¼ turn .			McEvoy valves have a round handwheel with the name "McEvoy" embossed on it. Operate McEvoy valves full open or full close, then back off ¼ turn .		
2,000/5,000 psi WP			2,000/3,000/5,000 psi WP		
Model	Inches	Turns	Model	Inches	Turns
205	2 1/16	13	C	2 1/16	13
	2 9/16	16		2 9/16	16
	3 1/8	20		3 1/8	18
	4 1/16	25		4 1/16	17
2,000/5,000 psi WP			10,000 psi WP		
405	2 1/16	16	E	1 13/16	11
	2 9/16	19		2 1/16	13
	3 1/8	23		2 9/16	10 1/2
	4 1/16	24 1/2		3 1/16	12 1/2
				4 1/16	17
10,000 – 15,000 psi WP			15,000 psi WP		
215	1 13/16	14	E	1 13/16	11
	2 1/16	12		2 1/16	9
	2 9/16	15		2 9/16	10 1/2
	3 1/16	17 1/2		3 1/16	26
	4 1/16	23		4 1/16	---
10,000 – 15,000 psi WP			10,000 psi WP		
315	1 13/16	16	E-2	1 13/16	11
	2 1/16	18		2 1/16	9
	2 9/16	17		2 9/16	10 1/2
	3 1/16	24		3 1/16	12 3/4
	4 1/16	21		4 1/16	17 1/8
			15,000 psi WP		
			E-2	1 13/16	7 3/4
				2 1/16	9
				2 9/16	10 1/2
				3 1/16	12 3/4
				4 1/16	17 1/8

Nominal Flange Size (In.)	Service Rating (psi)	Standard Ring Gasket Number	Energized Ring Number	Old API Series Designation	Through Bore ID (In.)	Number of Bolts	Bolt Size (In.)	Bolt Circle (In.)	Flange Diameter (In.)	Flange Thickness (In.)
1 13/16	10M		BX151		1 13/16	8	3/4	5 3/4	7 3/8	1 21/32
	15M		BX151		1 13/16	8	7/8	6 5/16	8 3/16	1 25/32
	20M		BX151		1 13/16	8	1	8	10 1/8	2 1/2
2 1/16	2M	R23	RX23	2" 600	2 1/16	8	5/8	5	6 1/2	1 5/16
	5M	R24	RX24	2" 1,500	2 1/16	8	7/8	6 1/2	8 1/2	1 13/16
	10M		BX152		2 1/16	8	3/4	6 1/4	7 7/8	1 47/64
	15M		BX152		2 1/16	8	7/8	6 7/8	8 3/4	2
	20M		BX152		2 1/16	8	1 1/8	9 1/16	11 5/16	2 13/16
	2M	R26	RX26	2 1/2" 600	2 9/16	8	3/4	5 7/8	7 1/2	1 7/16
2 9/16	5M	R27	RX27	2 1/2" 1,500	2 9/16	8	1	7 1/2	9 5/8	1 15/16
	10M		BX153		2 9/16	8	7/8	7 1/4	9 1/8	2 1/64
	15M		BX153		2 9/16	8	1	7 7/8	10	2 1/4
	20M		BX153		2 9/16	8	1 1/4	10 5/16	12 13/16	3 1/8
3 1/16	10M		BX154		3 1/16	8	1	8 1/2	10 5/8	2 19/64
	15M		BX154		3 1/16	8	1 1/8	9 1/16	11 5/16	2 17/32
	20M		BX154		3 1/16	8	1 3/8	11 5/16	14 1/16	3 3/8
3 1/8	2M	R31	RX31	3" 600	3 1/8	8	3/4	6 5/8	8 1/4	1 9/16
	3M	R31	RX31	3" 900	3 1/8	8	7/8	7 1/2	9 1/2	1 13/16
	5M	R35	RX35	3" 1,500	3 1/8	8	1 1/8	8	10 1/2	2 3/16

Nominal Flange Size (In.)	Service Rating (psi)	Standard Ring Gasket Number	Energized Ring Number	Old API Series Designation	Through Bore ID (In.)	Number of Bolts	Bolt Size (In.)	Bolt Circle (In.)	Flange Diameter (In.)	Flange Thickness (In.)
4 1/16	2M	R37	RX37	4" 600	4 1/16	8	7/8	8 1/2	10 3/4	1 13/16
	3M	R37	RX37	4" 900	4 1/16	8	1 1/8	9 1/4	11 1/2	2 1/16
	5M	R39	RX39	4" 1,500	4 1/16	8	1 1/4	9 1/2	12 1/4	2 7/16
	10M		BX155		4 1/16	8	1 1/8	10 3/16	12 7/16	2 49/64
	15M		BX155		4 1/16	8	1 3/8	11 7/16	14 3/16	3 3/32
	20M		BX155		4 1/16	8	1 3/4	14 1/16	17 9/16	4 3/16
	2M	R41	RX41		5 1/8	8	1	10 1/2	13	2 1/16
	3M	R41	RX41		5 1/8	8	1 1/4	11	13 3/4	2 5/16
5 1/8	5M	R44	RX44		5 1/8	8	1 1/2	11 1/2	14 3/4	3 3/16
	10M		BX169		5 1/8	12	1 1/8	11 13/16	14 1/16	3 3/8
	2M	R45	RX45	6" 600	7 1/16	12	1	11 1/2	14	2 3/16
	3M	R45	RX45	6" 900	7 1/16	12	1 1/8	12 1/2	15	2 1/2
	5M	R46	RX46	6" 1,500	7 1/16	12	1 3/8	12 1/2	15 1/2	3 5/8
	10M		BX156		7 1/16	12	1 1/2	15 7/8	18 7/8	4 1/16
	15M		BX156		7 1/16	16	1 1/2	16 7/8	19 7/8	4 11/16
	20M		BX156		7 1/16	16	2	21 13/16	25 13/16	6 1/2
7 1/16	2M	R49	RX49	8" 600	9	12	1 1/8	13 3/4	16 1/2	2 1/2
	3M	R49	RX49	8" 900	9	12	1 3/8	15 1/2	18 1/2	2 13/16
	5M	R50	RX50	8" 1,500	9	12	1 5/8	15 1/2	19	4 1/16
	10M		BX157		9	16	1 1/2	18 3/4	21 3/4	4 7/8
	15M		BX157		9	16	1 7/8	21 3/4	25 1/2	5 3/4
9										

Nominal Flange Size (In.)	Service Rating (psi)	Standard Ring Gasket Number	Energized Ring Number	Old API Series Designation	Through Bore ID (In.)	Number of Bolts	Bolt Size (In.)	Bolt Circle (In.)	Flange Diameter (In.)	Flange Thickness (In.)
11	2M	R53	RX53	10" 600	11	16	1 1/4	17	20	2 13/16
	3M	R53	RX53	10" 900	11	16	1 3/8	18 1/2	21 1/2	3 1/16
	5M	R54	RX54	10" 1,500	11	12	1 7/8	19	23	4 11/16
	10M		BX158		11	16	1 3/4	22 1/4	25 3/4	5 9/16
	15M		BX158		11	20	2	28	32	7 3/8
13 5/8	2M	R57	RX57	12" 600	13 5/8	20	1 1/4	19 1/4	22	2 15/16
	3M	R57	RX57	12" 900	13 5/8	20	1 3/8	21	24	3 7/16
	5M		BX160		13 5/8	16	1 5/8	23 1/4	26 1/2	4 7/16
	10M		BX159		13 5/8	20	1 7/8	26 1/2	30 1/4	6 5/8
	15M		BX159		13 5/8	20	2 1/4	30 3/8	34 7/8	7 7/8
16 3/4	2M	R65	RX65	16" 600	16 3/4	20	1 1/2	23 3/4	27	3 5/16
	3M	R66	RX66	16" 900	16 3/4	20	1 5/8	24 1/4	27 3/4	3 15/16
	5M		BX162		16 3/4	16	1 7/8	26 5/8	30 3/8	5 1/8
	10M		BX162		16 3/4	24	1 7/8	30 9/16	34 5/16	6 5/8
	5M		BX163		18 3/4	20	2	31 5/8	35 5/8	6 17/32
18 3/4	10M		BX164		18 3/4	24	2 1/4	36 7/16	40 15/16	8 25/32
20 3/4	3M	R74	RX74	20" 900	20 3/4	20	2	29 1/2	33 3/4	4 3/4
21 1/4	2M	R73	RX73	20" 600	21 1/4	24	1 5/8	28 1/2	32	3 7/8
21 1/4	5M		BX165		21 1/4	24	2	34 7/8	39	7 1/8
21 1/4	10M		BX166		21 1/4	24	2 1/2	40 1/4	45	9 1/2
26 3/4	2M		BX167		26 3/4	20	1 3/4	37 1/2	41	4 31/32
	3M		BX168		26 3/4	24	2	39 3/8	43 3/8	6 11/32

BOP Fluid Operating Volumes

Cameron BOPs			
Cameron Type 'D' Annular Preventer			
BOP Nom. Size	Working Pressure	Fluid to Close	Fluid to Open
In.	psi	gal	gal
7 1/16	5,000	1.69	1.39
	10,000	2.94	2.55
11	5,000	5.65	4.69
	10,000	10.15	9.06
13 5/8	5,000	12.12	10.34
	10,000	18.10	16.15

Cameron Type 'UM' Ram Preventer			
BOP Nom. Size	Working Pressure	Fluid to Close	Fluid to Open
In.	psi	gal	gal
7 1/16	3,000	2.3	2.2
	5,000	2.3	2.2
	10,000	2.3	2.2
	15,000	2.3	2.2
11	10,000	6.2	6.2
	15,000	7.3	7.3
13 5/8	5,000	7.5	7.5
	10,000	7.5	7.5

Cameron Type 'U' Ram Preventer			
BOP Nom. Size (Old API Series Designation)	Working Pressure	Fluid to Close	Fluid to Open
In.	psi	gal	gal
7 1/16 (6)	3,000	1.3	1.3
	5,000	1.3	1.3
7 1/16	10,000	1.3	1.3
	15,000	1.3	1.3
11 (10)	3,000	3.5	3.4
	5,000	3.5	3.4
11	10,000	3.5	3.4
	15,000	5.8	5.7
13 5/8 (12)	3,000	5.8	5.5
13 5/8	5,000	5.8	5.5
	10,000	5.8	5.5
	15,000	10.6	10.4
16 3/4	3,000	10.6	9.8
	5,000	10.6	9.8
	10,000	12.5	11.6
18 3/4	10,000	23.1	21.3
20 3/4 (20)	3,000	8.7	8.1
21 1/4	2,000	8.7	9.0
	5,000	30.0	27.3
	10,000	26.9	24.5
26 3/4	3,000	10.8	10.1

BOP Fluid Operating Volumes

Cameron Type 'QRC' Ram Preventer

BOP Nom. Size (Old API Series Designation)	Working Pressure	Fluid to Close	Fluid to Open
In.	psi	gal	gal
7 1/16 (6)	3,000	0.81	0.95
	5,000	0.81	0.95
9 (8)	3,000	2.36	2.70
	5,000	2.36	2.70
11 (10)	3,000	2.77	3.18
	5,000	2.77	3.18
13 5/8 (12)	3,000	4.42	5.10
16 3/4 (16)	2,000	6.00	7.05
17 3/4 (18)	2,000	6.00	7.05

Cameron Hydraulic Gate Valves

Type	Valve Size	Working Pressure	Fluid to Close	Fluid to Open
	In.	psi	gal	gal
HCR	4	3,000	0.52	0.61
HCR	4	5,000	0.52	0.61
HCR	6	3,000	1.95	2.25
HCR	6	5,000	1.95	2.25
F	4	3,000	0.30	0.30
F	4	5,000	0.30	0.30
F	4	10,000	0.59	0.59
F	6	3,000	0.84	0.84
F	6	5,000	0.84	0.84

Shaffer BOPs

Shaffer Spherical Annular Preventer

BOP Nom. Size	Working Pressure	Cover Type	Fluid to Close	Fluid to Open
In.	psi		gal	gal
7 1/16	3,000	Bolted	4.57	3.21
	5,000	Bolted	4.57	3.21
	10,000	Bolted	17.11	13.95
9	3,000	Bolted	7.23	5.03
	5,000	Bolted	11.05	8.72
11	3,000	Bolted	11.00	6.78
	5,000	Bolted	18.67	14.59
	10,000	Wedge	30.58	24.67
13 5/8	3,000	Bolted	23.50	14.67
	5,000	Bolt/Wedge	23.58	17.41
	10,000	Wedge	40.16	32.64
16 3/4	5,000	Wedge	33.26	25.61
18 3/4	5,000	Wedge	48.16	37.61
21 1/4	2,000	Bolted	32.59	16.92
	5,000	Wedged	61.37	47.76

BOP Fluid Operating Volumes

Shaffer Type 'LXT' Ram Preventer

BOP Nom. Size	Working Pressure	Fluid to Close	Fluid to Open
In.	psi	gal	gal
7	3,000	0.32	0.33
	5,000	0.32	0.33
11	3,000	2.80	2.46
	5,000	2.80	2.46

Shaffer Type 'NXT' Ram Preventer

BOP Nom. Size	Working Pressure	Type	Fluid to Close	Fluid to Open
In.	psi		gal	gal
18 3/4	5,000	Poslock	14.04	12.74
	5,000	Booster (Poslock)	31.22	29.92
	5,000	Manual-Lock	13.14	12.84
	5,000	Ultralock IIB	16.74	15.44
	10,000	Poslock	14.04	13.02
	10,000	Booster (Poslock)	31.22	29.92
	10,000	Manual-Lock	13.14	13.14
	10,000	Ultralock IIB	16.74	15.72
	15,000	Poslock	14.04	13.02
	15,000	Booster (Poslock)	31.22	29.92
	15,000	Manual-Lock	13.14	13.14
	15,000	Ultralock IIB	16.74	15.72

Shaffer Type 'LWS' Ram Preventer

BOP Nom. Size	Working Pressure	Piston Size	Fluid to Close	Fluid to Open
In.	psi	In.	gal	In.
4 1/16	5,000	6	0.59	0.52
	10,000	6	0.59	0.52
7 1/16	5,000	6 1/2	1.45	1.18
	10,000	14	5.18	5.25
9	5,000	8 1/2	2.58	2.27
11	3,000	6 1/2	1.74	1.45
	5,000	8 1/2	2.98	2.62
	5,000	14	9.50	8.90
20 3/4	3,000	8 1/2	5.07	4.46
	3,000	10	7.80	6.86
	3,000	14	14.50	13.59
21 1/4	2,000	8 1/2	5.07	4.46
	2,000	10	7.80	6.86
	2,000	14	14.50	13.59

BOP Fluid Operating Volumes

Shaffer Type 'SL/SLX' Ram Preventer				
BOP Nom. Size	Working Pressure	Piston Size	Fluid to Close	Fluid to Open
In.	psi	In.	gal	gal
7 1/16	10,000	10	2.72	2.34
	10,000	14	6.00	5.57
	15,000	10	2.72	2.34
	15,000	14	6.00	5.57
11	10,000	14	9.45	7.00
	15,000	14	9.40	8.10
13 5/8	3,000	10	5.44	4.46
	5,000	10	5.44	4.46
	5,000	14	11.00	10.52
	10,000	14	10.58	10.52
	15,000	14	11.56	10.52
16 3/4	5,000	10	6.07	4.97
	5,000	14	11.76	10.67
	10,000	14	14.47	12.50
18 3/4	10,000	14	14.55	13.21
	15,000	14	14.62	13.33
21 1/4	10,000	14	16.05	13.86

Shaffer Type 'DB' Hydraulic Gate Valves			
Valve Size	Working Pressure	Fluid to Close	Fluid to Open
In.	psi	gal	gal
2 1/16	5,000	0.15	0.20
	10,000	0.15	0.20
	15,000	0.26	0.29
3 1/8	5,000	0.20	0.25
3 1/16	10,000	0.35	0.40
	15,000	0.35	0.40
4 1/16	5,000	0.35	0.40
	10000	0.45	0.50
	15000	0.45	0.50

BOP Fluid Operating Volumes

Hydril BOPs			
Hydril Type 'GK' Annular Preventer			
BOP Nom. Size	Working Pressure	Fluid to Close	Fluid to Open
In.	psi	gal	gal
7 1/16	3,000	2.85	2.24
	5,000	3.86	3.30
	10,000	9.42	7.08
	15,000	11.20	7.50
	20,000	10.90	7.20
9	3,000	4.33	3.41
	5,000	6.84	5.80
	10,000	15.90	11.95
11	3,000	7.43	5.54
	5,000	9.81	7.98
	10,000	25.10	18.97
	15,000	26.67	20.45
13 5/8	3,000	11.36	8.94
	5,000	17.98	14.16
	10,000	37.18	12.59
16 3/4	2,000	17.46	15.80
	3,000	28.70	19.93
	5,000	28.70	19.93

Hydril Type 'MSP' Annular Preventer			
BOP Nom. Size	Working Pressure	Fluid to Close	Fluid to Open
In.	psi	gal	gal
7 1/16	2,000	2.85	1.98
9	2,000	4.57	2.95
11	2,000	7.43	5.23
20 3/4	2,000	31.05	18.93
21 1/4	2,000	31.05	18.93
29 1/2	500	60.00	n/a
30	1,000	87.60	27.80

Hydril Type 'GX' Annular Preventer			
BOP Nom. Size	Working Pressure	Fluid to Close	Fluid to Open
In.	psi	gal	gal
11	10,000	17.90	17.90
	15,000	24.10	24.10
13 5/8	5,000	15.50	15.50
	10,000	24.10	24.10
18 3/4	10,000	58.00	58.00

BOP Fluid Operating Volumes

Hydril Type 'GL' Annular Preventer

BOP Nom. Size	Working Pressure	Fluid to Close	Fluid to Open	Secondary Fluid
In.	psi	gal	gal	gal
13 ⁵ / ₈	5,000	19.76	19.76	8.24
16 ³ / ₄	5,000	33.80	33.80	17.30
18 ³ / ₄	5,000	44.00	44.00	20.00
21 ¹ / ₄	5,000	58.00	58.00	29.50

Hydril Manual Lock Ram Preventer

BOP Nom. Size	Working Pressure	Fluid to Close	Fluid to Open
In.	psi	gal	gal
7 ¹ / ₁₆	3,000	1.00	0.93
	5,000	1.00	0.93
	10,000	1.90	1.80
	15,000	3.70	3.40
9	3,000	1.90	1.90
	5,000	1.90	1.90
11	3,000	3.30	3.20
	5,000	3.30	3.20
	10,000	5.20	5.00
13 ⁵ / ₈	3,000	5.40	4.90
	5,000	5.40	4.80
	10,000	12.20	11.60
18 ³ / ₄	5,000	17.10	16.10
20 ³ / ₄	3,000	8.10	7.20
21 ¹ / ₄	2,000	8.10	7.20
	5,000	17.50	16.60

Hydril MPL Ram Preventer

BOP Nom. Size	Working Pressure	Fluid to Close	Fluid to Open
In.	psi	gal	gal
7 ¹ / ₁₆	3,000	1.20	0.93
	5,000	1.20	0.93
	10,000	2.00	1.80
	15,000	3.90	3.40
11	10,000	5.70	5.00
	20,000	12.50	11.50
13 ⁵ / ₈	3,000	5.90	4.90
	5,000	5.90	5.20
	10,000	12.80	11.60
	15,000	12.60	11.00
18 ³ / ₄	5,000	17.90	16.10
	10,000	17.10	15.60
	15,000	19.40	16.70
20 ³ / ₄	3,000	18.00	16.30
21 ¹ / ₄	2,000	18.00	16.30
	5,000	19.30	16.60

Coiled Tubing Data

Coiled Tubing Stretch Table			
Size OD	Wall Thickness	Cross Sectional Area	Free Point Constant
In.	In.	Sq In.	
1.250	.087	.304	760.0
	.095	.328	820.0
	.102	.351	877.5
	.109	.374	935.0
	.125	.420	1050.0
	.134	.451	1127.5
	.156	.512	1280.0
1.500	.095	.399	997.5
	.102	.428	1070.0
	.109	.456	1140.0
	.125	.512	1280.0
	.134	.552	1380.0
	.156	.629	1572.5
1.750	.109	.538	1345.0
	.125	.605	1512.5
	.134	.652	1630.0
	.156	.745	1862.5
	.175	.831	2077.5
2.0	.109	.619	1547.5
	.125	.698	1745.0
	.134	.753	1882.5
	.156	.861	2152.5
	.175	.962	2405.0
2.375	.125	.837	2092.5
	.134	.904	2260.0
	.156	1.035	2587.5
	.175	1.158	2895.5
	.190	1.241	3102.5

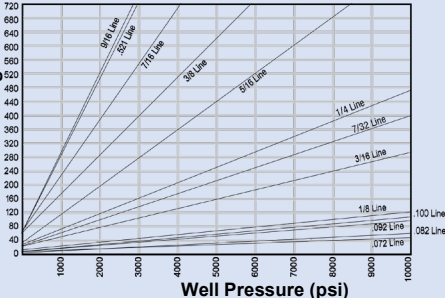
OD Specified	Wall Specified	ID Calculated	Nom. Wt lbs/ft	Internal Capacity /ft		Displacement of Steel/ft		External Displacement/ft		OD Specified	Wall Specified	ID Calculated	Nom Wt lbs/ft	Internal Capacity		Displacement Of Steel		External Displacement	
				Gallons	bbbls	Gallons	bbbls	Gallons	bbbls					Gallons	bbbls	Gallons	bbbls	Gallons	bbbls
1.00	.080	.840	.788	.02879	.000685	.01201	.00029	.04080	.00097	1.50	.116	1.268	1.719	.06560	.001562	.02620	.00062	.09180	.00219
1.00	.087	.826	.850	.02784	.000663	.01296	.00031	.04080	.00097	1.50	.125	1.250	1.840	.06375	.001518	.02805	.00067	.09180	.00219
1.00	.095	.810	.920	.02677	.000637	.01403	.00033	.04080	.00097	1.50	.134	1.232	1.960	.06193	.001474	.02987	.00071	.09180	.00219
1.00	.102	.796	.981	.02585	.000616	.01495	.00036	.04080	.00097	1.50	.145	1.210	2.104	.05974	.001422	.03206	.00076	.09180	.00219
1.00	.109	.782	1.040	.02495	.000594	.01585	.00038	.04080	.00097	1.50	.156	1.188	2.245	.05758	.001371	.03422	.00081	.09180	.00219
1.25	.080	1.090	1.002	.04847	.001154	.01528	.00036	.06375	.00152	1.50	.175	1.150	2.483	.05396	.001285	.03784	.00090	.09180	.00219
1.25	.087	1.076	1.083	.04724	.001125	.01651	.00039	.06375	.00152	1.50	.190	1.120	2.665	.05118	.001219	.04062	.00097	.09180	.00219
1.25	.095	1.060	1.175	.04584	.001091	.01791	.00043	.06375	.00152	1.75	.109	1.532	1.915	.09576	.002280	.02919	.00070	.12495	.00298
1.25	.102	1.046	1.254	.04464	.001063	.01911	.00046	.06375	.00152	1.75	.116	1.518	2.029	.09402	.002238	.03093	.00074	.12495	.00298
1.25	.109	1.032	1.332	.04345	.001035	.02030	.00048	.06375	.00152	1.75	.125	1.500	2.175	.09180	.002186	.03315	.00079	.12495	.00298
1.25	.116	1.018	1.408	.04228	.001007	.02147	.00051	.06375	.00152	1.75	.134	1.482	2.318	.08961	.002134	.03534	.00084	.12495	.00298
1.25	.125	1.000	1.506	.04080	.000971	.02295	.00055	.06375	.00152	1.75	.145	1.460	2.492	.08697	.002071	.03798	.00090	.12495	.00298
1.25	.134	.982	1.601	.03934	.000937	.02441	.00058	.06375	.00152	1.75	.156	1.438	2.662	.08437	.002009	.04058	.00097	.12495	.00298
1.25	.145	.960	1.715	.03760	.000895	.02615	.00062	.06375	.00152	1.75	.175	1.400	2.951	.07997	.001904	.04498	.00107	.12495	.00298
1.25	.156	.938	1.827	.03590	.000855	.02785	.00066	.06375	.00152	1.75	.188	1.374	3.140	.07703	.001834	.04792	.00114	.12495	.00298
1.25	.175	.900	2.014	.03305	.000787	.03070	.00073	.06375	.00152	1.75	.190	1.370	3.173	.07658	.001823	.04837	.00115	.12495	.00298
1.50	.095	1.310	1.429	.07002	.001667	.02178	.00052	.09180	.00219	2.00	.109	1.782	2.207	.12956	.003085	.03364	.00080	.16320	.00389
1.50	.102	1.296	1.527	.06853	.001632	.02327	.00055	.09180	.00219	2.00	.116	1.768	2.340	.12753	.003037	.03567	.00085	.16320	.00389
1.50	.109	1.282	1.623	.06706	.001597	.02474	.00059	.09180	.00219	2.00	.125	1.750	2.509	.12495	.002975	.03825	.00091	.16320	.00389

OD Specified	Wall Specified	ID Calculated	Nom. Wt lbs/ft	Internal Capacity/ft		Displacement of Steel/ft		External Displacement/ft		OD Specified	Wall Specified	ID Calculated	Nom Wt lbs/ft	Internal Capacity		Displacement Of Steel		External Displacement	
				Gallons	bbbls	Gallons	bbbls	Gallons	bbbls					Gallons	bbbls	Gallons	bbbls	Gallons	bbbls
2.00	.134	1.732	2.677	.12239	.002914	.04081	.00097	.16320	.00389	2.875	.156	2.563	4.541	.26801	.006381	.06922	.00165	.33724	.00803
2.00	.145	1.710	2.880	.11930	.002841	.04390	.00105	.16320	.00389	2.875	.175	2.525	5.059	.26013	.006193	.07711	.00184	.33724	.00803
2.00	.156	1.688	3.080	.11625	.002768	.04695	.00112	.16320	.00389	2.875	.188	2.499	5.400	.25480	.006067	.08244	.00196	.33724	.00803
2.00	.175	1.650	3.419	.11108	.002645	.05212	.00124	.16320	.00389	2.875	.190	2.495	5.462	.25398	.006047	.08326	.00198	.33724	.00803
2.00	.188	1.624	3.640	.10760	.002562	.05560	.00132	.16320	.00389	2.875	.203	2.469	5.790	.24872	.005922	.08852	.00211	.33724	.00803
2.00	.190	1.620	3.682	.10708	.002549	.05612	.00134	.16320	.00389	2.875	.204	2.467	5.834	.24831	.005912	.08893	.00212	.33724	.00803
2.00	.203	1.594	3.900	.10367	.002468	.05953	.00142	.16320	.00389	3.500	.134	3.232	4.820	.42619	.010147	.07361	.00175	.49980	.01190
2.00	.204	1.592	3.923	.10341	.002462	.05979	.00142	.16320	.00389	3.500	.156	3.188	5.570	.41466	.009873	.08514	.00203	.49980	.01190
2.375	.125	2.125	3.011	.18424	.004387	.04590	.00109	.23014	.00548	3.500	.175	3.150	6.230	.40484	.009639	.09496	.00226	.49980	.01190
2.375	.134	2.107	3.215	.18113	.004313	.04901	.00117	.23014	.00548	3.500	.188	3.124	6.650	.39818	.009481	.10162	.00242	.49980	.01190
2.375	.145	2.085	3.462	.17737	.004223	.05277	.00126	.23014	.00548	3.500	.190	3.120	6.733	.39716	.009456	.10264	.00244	.49980	.01190
2.375	.156	2.063	3.706	.17364	.004134	.05649	.00135	.23014	.00548	3.500	.203	3.094	7.150	.39057	.009299	.10923	.00260	.49980	.01190
2.375	.175	2.025	4.122	.16731	.003983	.06283	.00150	.23014	.00548	3.500	.204	3.092	7.199	.39007	.009287	.10973	.00261	.49980	.01190
2.375	.188	1.999	4.390	.16304	.003882	.06710	.00160	.23014	.00548	3.500	.224	3.052	7.857	.38004	.009049	.11976	.00285	.49980	.01190
2.375	.190	1.995	4.445	.16239	.003866	.06775	.00161	.23014	.00548	3.500	.250	3.000	8.699	.36720	.008743	.13260	.00316	.49980	.01190
2.375	.203	1.969	4.710	.15818	.003766	.07196	.00171	.23014	.00548	4.500	.204	4.092	9.383	.68317	.016266	.14303	.00341	.82620	.01967
2.375	.204	1.967	4.742	.15786	.003759	.07228	.00172	.23014	.00548	4.500	.224	4.052	10.255	.66988	.015950	.15632	.00372	.82620	.01967
2.875	.125	2.625	3.670	.28114	.006694	.05610	.00134	.33724	.00803	4.500	.250	4.000	11.376	.65280	.015543	.17340	.00413	.82620	.01967

Cable Type	Size In.	Diameter In.	Breaking Strength lbs	Weight (lbs) 1000ft	Armor Wires Out/In	Wire BS – lbs Out/In	CDR Resistance Ohms/Mft	Maximum Temp °F
1-H-100-A	1/10	.101	1,000	19	18/12	41/41	25.2	300
1-H-125-A	1/8	.123	1,500	27	18/12	60/60	25.2	300
1-H-125-K	1/8	.123	1,500	28	18/12	60/60	25.2	500
1-H-181-A	3/16	.185	3,900	63	15/12	198/127	9.8	300
1-H-181-D	3/16	.185	3,900	65	15/12	198/127	9.8	420
1-H-181-K	3/16	.185	3,900	65	15/12	198/127	9.8	500
1-H-181-M	3/16	.187	3,600	68	15/12	198/132	12.5	600
4-H-181-A	3/16	.186	3,300	60	18/18	143/76	26.0	300
1-H-203-A	13/64	.203	4,500	79	16/10	212/212	6.9	300
1-H-203-D	13/64	.203	4,500	79	16/10	212/212	6.9	420
1-H-203-K	13/64	.203	4,500	80	16/10	212/212	6.9	500
1-H-220-A	7/32	.223	5,500	92	18/12	212/212	4.5	300
1-H-220-D	7/32	.223	5,500	95	18/12	212/212	4.5	420
1-H-220-K	7/32	.223	5,500	95	18/12	212/212	4.5	500
1-H-226-K	7/32	.222	5,000	99	18/12	196/196	7.7	500
1-H-281-A	9/32	.288	10,000	153	18/12	352/352	2.8	300
1-H-281-K	9/32	.288	10,000	158	18/12	352/352	2.8	500
1-H-314-A	5/16	.316	11,200	183	18/12	426/426	2.8	300
1-H-314-D	5/16	.316	11,200	187	18/12	426/426	2.8	420
1-H-314-K	5/16	.316	11,200	190	18/12	426/426	2.8	500

Cable Type	Size	Diameter	Breaking Strength	Weight (lbs)	Armor Wires	Wire BS – lbs	CDR Resistance	Maximum Temp
7-H-314-A	5/16	.323	9,600	180	18/18	426/225	16.6	300
1-H-375-A	3/8	.375	14,600	253	18/12	595/595	2.9	300
1-H-375-D	3/8	.375	14,600	260	18/12	595/595	2.9	420
1-H-375-K	3/8	.375	14,600	261	18/12	595/595	2.9	500
3-H-375-A	3/8	.372	13,500	235	20/16	486/397	7.1	300
4-H-375-A	3/8	.372	13,500	239	20/16	572/301	10.5	300
7-H-375-A	3/8	.372	12,800	243	18/18	572/301	10.5	300
1-H-422-A	7/16	.414	17,800	307	18/12	727/727	2.9	300
1-H-422-D	7/16	.414	17,800	316	18/12	727/727	2.9	420
1-H-422-K	7/16	.414	17,800	317	18/12	727/727	2.9	500
7-H-422-A	7/16	.426	18,300	314	18/18	766/397	10.9	300
7-H-422-D	7/16	.426	18,300	324	18/18	766/397	10.0	420
7-H-422-K	7/16	.426	18,300	326	18/18	766/397	10.0	500
7-H-464-A	15/32	.462	18,300	326	24/24	539/335	10.0	300
7-H-464-D	15/32	.462	18,300	333	24/24	539/335	10.0	420
7-H-464-K	15/32	.462	18,300	347	24/24	539/335	10.0	500
7-H-520-A	17/32	.522	26,000	462	20/16	958/778	10.5	300
7-H-520-D	17/32	.522	26,000	467	20/16	958/778	10.5	420
7-H-472-A	Slammer	.472	22,200	379	18/18	929/486	10.0	300
7-H-472-D	Slammer	.472	22,200	386	18/18	929/486	10.0	420
7-H-472-K	Slammer	.472	22,200	394	18/18	929/486	10.0	500

Sinker Bar Weight Needed



Carbon Steel – API 9A Breaking Strengths

Material (In)	.072	.082	.092	.105	.108	.125
Br. Steel API Level 3 or improved plow (lbs)	961	1239	1547	1966	2109	2794
API Ex. Impr. Plow, Hi-Str, or Mon. AA (lbs)	1150	1460	1830	2360	2490	3300
Austenitic Stainless Steel – Breaking Strengths						
Material (In)	.082	.092	.105	.108	.125	
316 Stainless (lbs)	1083	1363	1732	1786	2270	
Super Austenitic Stainless – Breaking Strengths						
Material (In)	.092	.105	.108	.125		
Sandvik Sanicro 28 (lbs)	1445	1885	1995	2675		
6 Moly Stainless Steel – Breaking Strengths						
Material (In)	.092	.105	.108	.125		
Avesta 254 SMO (lbs)	1462	1818	1924	2454		
Bridon Supa (lbs)	1550	2030	2030	2560		
25-6MO (lbs)	1475	N/A	2050	2550		
Cobalt Based Alloy – Breaking Strengths						
Material (In)	.092	.105	.108	.125		
MP35N (lbs)	1582	2009	2080	2724		
Braided Line – Breaking Strengths						
Size (In)	3/16"	3/16"	7/32"	7/32"		
Construction	1 x 16	1x 19 (Dycan/Dyfor m)	1 x 16	1 x 16	1x 19 (Dycan/Dyfor m)	
Galv. Carbon Steel	4500	6170	6000	8370		
15-6Mo (Supa 75)	4320	4960	5842	5990		

For wireline to fall against well pressure, find desired line versus well pressure and extrapolate total sinker bar weight needed.

All "lbs" are breaking strength. These vary with the manufacturer.

Conversions Factors

Field Units to Metric Conversion		
If You Have:	Multiply By:	To Get:
Feet	x 0.3048	Meters (M)
Inches	x 2.54	Centimeters (cm)
Inches	x 25.4	Millimeters (mm)
Pounds (Lbs)	x 0.0004536	Metric Tons
Pounds (Lbs)	x 0.44482	Decanewtons (daN)
Pounds	x 0.4536	Kilograms
Weight (Lbs/ft)	x 1.4882	Kg/M
Pounds per Barrel	x 2.85307	Kg/M ³
Barrels	x 158.987	Liters
Barrels	x 0.15898	Cubic Meters
Gallons	x 3.7854	Liters
Gallons	x 0.0037854	Cubic Meters
Barrels/Stroke	x 158.987	Liters/Stroke
Barrels/Stroke	x 0.158987	Cubic Meters/Stroke
Gallons/Minute	x 3.7854	Liters/Minute
Barrels/Minute	x 158.987	Liters/Minute
Barrels/Minute	x 0.158987	Cubic Meters/Minute
bbl/ft. Capacity	x 521.612	Liters/Meter (L/M)
bbl/ft. Capacity	x 0.521612	Cubic Meters/Meter
Bbl Displacement	x 521.612	Liters/Meter (L/M)
Bbl Displacement	x 0.521612	Cubic Meters/Meter
Gradient psi/ft	X 22.6206	KPa/M
Gradient psi/ft	x 0.226206	Bar/M
Mud Weight PPG	x 0.119826	Kilograms/Liter (Kg/L)
Mud Weight PPG	x 119.826	Kilograms/Cubic Meter
Mud Weight PPG	x 0.119826	Specific Gravity (SG)
Mud Weight (Lb/Ft ³)	x 1.60185	Kg/M ³
Fahrenheit Degrees	x 0.56 – 17.8	Celsius Degrees
PSI	x 6894.8	Pascals (Pa)
PSI	x 6.8948	Kilopascals (KPa)
PSI	x 0.06895	Bar
BWPD @ 8.9 ppg	X 0.118	Kg/Min
BOPD @ 7.74 ppg	X 0.099	Kg/Min
mmCFD @ 0.6 sp. gr.	X 14.1	Kg/Min

Conversions Factors

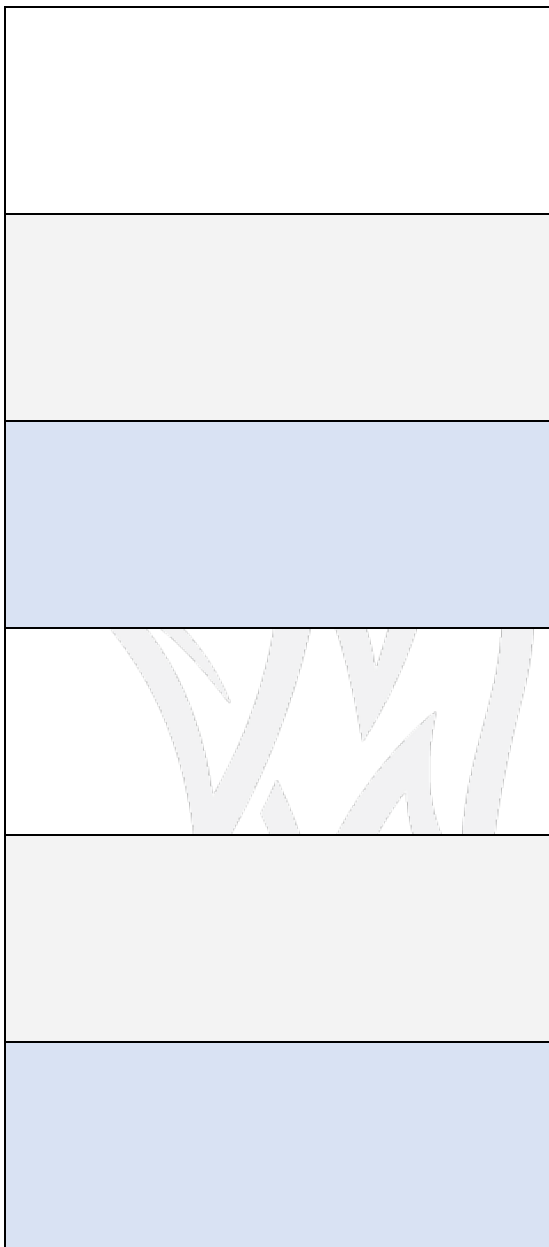
Metric to Field Units Conversion		
If You Have:	Multiply By:	To Get:
Meters (m)	x 3.2808	Feet
Centimeters (cm)	x 0.3937	Inches
Millimeters (mm)	x 0.03937	Inches
Metric Tons	x 2204.6	Pounds (Lbs)
Decanewtons (daN)	x 2.2481	Pounds (Lbs)
Kilograms	x 2.2046	Pounds
Kg/m	x 0.67196	Weight (Lbs/Ft)
Kg/m ³	x 0.3505	Pounds per Barrel
Liters	x 0.00629	Barrels
Cubic Meters	x 6.2898	Barrels
Liters	x 0.2642	Gallons
Cubic Meters	x 264.173	Gallons
Liters/Stroke	x 0.00629	Barrels/Stroke
Cubic Meters/Stroke	x 6.2898	Barrels/Stroke
Liters/Minute	x 0.2642	Gallons/Minute
Liters/Minute	x 0.00629	Barrels/Minute
Cubic Meters/Minute	x 6.2898	Barrels/Minute
Liters/Meter (l/m)	x 0.0019171	BBL/Ft. Capacity
Cubic Meters/Meter	x 1.917	BBL/Ft. Capacity
Liters/Meter (l/m)	x 0.0019171	BBL Displacement
Cubic Meters/Meter	x 1.9171	BBL Displacement
KPa/m	x 0.044207	Gradient PSI/Ft
Bar/m	x 4.4207	Gradient PSI/Ft
Kilograms/Liter (Kg/L)	x 8.3454	Mud Weight PPG
Kilograms/Cubic Meter	x 0.0083454	Mud Weight PPG
Specific Gravity (SG)	x 8.3454	Mud Weight PPG
Kg/m ³	x 6.24279	Mud Weight Lb/Ft ³)
Celsius Degrees	x 1.8 + 32	Fahrenheit Degrees
Pascals (Pa)	x 0.000145	PSI
Kilopascals (KPa)	x 0.14504	PSI
Bar	x 14.50377	PSI
Kg/Minute	X 8.475	BWPD @ 8.9 ppg
Kg/Minute	X 10.105	BOPD @ 7.74 ppg
Kg/Minute	X 0.071	mmCFD @ 0.6 sp.gr.

Notes & Calculations

[illegible]

Notes & Calculations

Notes & Calculations





WILD WELL

CONTROL



Consider it covered.

wildwell.com | +1 281 784.4700

