

## USEFUL FORMULAS IN DRILLING/WELL ENGINEERING

1) CAPACITY =  $\frac{I.D.^2}{1029.4}$  = BBL/FT

2) DISPLACEMENT =  $\frac{O.D.^2 - I.D.^2}{1029.4}$  = BBL/FT

3) WEIGHT = DISPLACEMENT BBL/FT \* 2747 LBS/BBL = LBS/FT

4) APPROXIMATE DRILL COLLAR WEIGHT CAN BE OBTAINED AS FOLLOWS:

REGULAR DRILL COLLARS

$$OD^2 - ID^2 * 2.66 = WT., \#/FT.$$

SPIRAL DRILL COLLARS

$$OD^2 - ID^2 * 2.56 = WT., \#/FT.$$

5) DETERMINE PRESSURE GRADIENT

$$(MUD WT., PPG) * (.052) = PSI$$

6) DETERMINE HYDROSTATIC PRESSURE

$$(MUD WT., PPG) * (.052) * (TVD) = PSI$$

7) MAXIMUM ALLOWABLE SHUT- IN CASING PRESSURE

$$(MAX. ALLOWABLE MUD WT.) - (MUD WT. IN USE) * (.052) * (CASING TVD) = PSI$$

8) CONVERTING PRESSURE TO MUD WT.

$$\frac{PRESSURE, PSI}{.052 * T.V.D.} = MUD WT., PPG$$

9) KILL WT. MUD, PPG

$$\frac{(SIDPP, PSI)}{(.052) * (TVD)} + OLD MUD WT. = KILL WT. MUD$$

10) EQUIVALENT MUD WT., PPG

$$\frac{(PRESSURE, PSI)}{(.052) * (TVD)} + (O.M.W.) = EMW$$

11) EQUIVALENT CIRCULATING DENSITY

$$\frac{(ANNULAR PRESSURE LOSS)}{(.052) * (TVD)} + (O.M.W.) = (E.C.D.)$$

12) MAXIMUM ALLOWABLE MUD WT.

$$\frac{(\text{LEAK-OFF PRESSURE, PSI})}{(.052)} + (\text{TEST MUD WT.}) = \text{PPG.}$$

13) CONVERTING PRESSURE GRADIENT, PSI/FT TO MUD WT., PPG

$$\frac{(\text{PRESSURE GRADIENT, PSI/FT})}{(.052)} = \text{MUD WT., PPG}$$

14) OUTPUT OF TRIPLEX PUMP, BBLs/STK.

$$(.000243) * (\text{DIAMETER, IN.})^2 * (\text{LENGTH, IN.}) = \text{PUMP OUTPUT @ 100\%}$$

15) ANNULAR VELOCITY, FT./MIN.

$$\frac{(\text{PUMP OUTPUT, BBLs/MIN.})}{(\text{ANNULAR VOLUME, BBLs/MIN.})} \quad \text{OR} \quad V = \frac{(24.5) * \text{FLOW RATE}}{(\text{Dh})^2 - (\text{Dp})^2}$$

16) DETERMINE ANNULAR VOLUME

$$\frac{(\text{HOLE DIAMETER, IN.})^2 - (\text{PIPE O.D., IN.})^2}{1029.4} = \text{BBLs./FT}$$

17) PUMP PRESSURE/PUMP STROKES RELATIONSHIP

$$(\text{PRESENT PUMP PRESS., PSI}) * \frac{(\text{NEW SPM})^2}{(\text{OLD SPM})^2} = \text{NEW PUMP PRESS., PSI}$$

18) FORMULA TO DETERMINE CUBIC FT. OF CUTTINGS DRILLED/FT.

$$\frac{(\text{Dh})^2}{144} * .785 = \text{CUBIC FT. OF CUTTINGS FOR EACH FT. DRILLED}$$

19) FORMULA TO DETERMINE BBLs. OF CUTTINGS FOR EACH FT. DRILLED

$$\frac{(\text{Dh})^2}{1029.4} = \text{BBLs. OF CUTTINGS FOR EACH FT. DRILLED}$$

20) HYDROSTATIC PRESSURE DECREASE WHEN PULLING PIPE

STEP 1

$$\text{BBLs. DISPLACED} = (\text{NO. OF STANDS PULLED}) * (\text{LENGTH OF STD.}) * (\text{PIPE DISPLACEMENT}) = \text{BBLs}$$

STEP 2

$$\frac{\text{BARRELS DISPLACED}}{\text{CSG. CAP. - PIPE DISPLACEMENT}} * (.052) * (\text{MUD WT.}) = \text{H.P. DECREASE}$$

21) DRILL PIPE/DRILL COLLAR CAPACITY

$$\frac{\text{ID}^2}{1029.4} * (\text{LENGTH, FT.}) = \text{DRILL PIPE CAPACITY}$$

22) CAPACITY OF ANY SIZE OF PIPE OR CYLINDER

$$\frac{ID^2}{1029.4} = \text{BBLs. / FT}$$

23) ANNULAR VOLUME

$$\frac{Dh^2 - Dp^2}{1029.4} = \text{BBLs./FT}$$

24) FORMULA TO DETERMINE BUOYANCY FACTOR

$$\frac{65.5 - \text{MUD WT., PPG}}{65.5} = \text{B.F.}$$

25) LBS. OF BARITE TO INCREASE MUD WT. PPG.

$$\frac{1470 * (\text{DESIRED M.W.,PPG.} - \text{INITIAL M.W., PPG})}{(35 - \text{DESIRED MUD WT., PPG})} = \text{LBS./BBL.}$$

26) MUD WEIGHT REDUCTION WITH WATER

$$(\text{MUD VOLUME BBLs}) * \frac{(W1 - W2)}{(W2 - 8.33)} = \text{BBLs. OF WATER REQUIRED}$$

27) INITIAL CIRCULATING PRESSURE

$$(\text{SIDPP,PSI}) + (\text{KILL RATE PRESSURE,PSI}) = \text{IDPP,PSI}$$

28) FINAL DRILL PIPE CIRCULATING PRESSURE

$$\frac{(\text{KILL WT. MUD,PPG.}) * (\text{KILL RATE PRESS.})}{(\text{O.M.W., PPG})} = \text{F.D.P.P.,PSI}$$

29) SHUT-IN DRILL PIPE PRESSURE, PSI.

$$(\text{FORMATION PRESSURE,PSI}) - (\text{H.P. OF MUD IN DRILL STRING}) = \text{SIDPP}$$

30) SHUT-IN CSG. PRESSURE

$$(\text{FORMATION PRESSURE,PSI}) - (\text{H.P. OF MUD} + \text{H.P. OF INFLUX IN ANNULAS}) = \text{SICP}$$

31) HEIGHT OF INFLUX,FT.

$$\frac{(\text{PIT GAIN,BBLs})}{\text{ANNULAR VOLUME,BBLs/FT.}} = \text{FEET}$$

32) ESTIMATED TYPE OF INFLUX

$$\text{MUD WT.,PPG} - \frac{(\text{SICP} - \text{SIDPP})}{(\text{HEIGHT OF INFLUX,FT.}) * .052} = \text{PPG}$$

THEN: 1-3 PPG = GAS KICK  
 4-6 PPG = COMBINATION/OIL KICK  
 7-9 PPG = SALTWATER KICK

33) DRILL PIPE PRESSURE LOSS

$$\text{PRESS LOSS} = \frac{(0.000061) * (\text{MUD WT.}) * (\text{LENGTH}) * (\text{FLOW RATE})}{4.86} \quad 1.86$$

(INSIDE DIAMETER)

34) HYDRAULIC HORSEPOWER

$$\text{HHp} = \frac{(\text{PRESSURE}) * (\text{FLOW RATE})}{1714}$$

35) JET NOZZLE PRESSURE LOSS

$$\text{PRESSURE DROP} = \frac{(\text{MUD WT.}) * (\text{FLOW RATE})^2}{(\text{AREA OF NOZZLES})^2}$$

36) JET VELOCITY

$$\text{VELOCITY} = \frac{(0.32086) * (\text{FLOW RATE})}{(\text{AREA OF NOZZLE})}$$

37) JET IMPACT FORCE

$$\text{IMPACT FORCE} = 0.000516 * (\text{MUD WT.}) * (\text{FLOW RATE}) * (\text{JET VELOCITY})$$

38) BBLS. PER FOOT (CYLINDRICAL TANKS)

$$\text{BBLs} = .1400 * D^2 \text{ (ft)}$$

39) BBLS. PER INCH (CYLINDRICAL TANKS)

$$\text{BBLs} = .01165 * D^2 \text{ (ft)}$$

40) GALLONS PER FOOT (CYLINDRICAL TANKS)

$$\text{GALS} = 5.8752 * D^2 \text{ (ft)}$$

41) GALLONS PER INCH (CYLINDRICAL TANKS)

$$\text{GALLONS} = 0.4896 * D^2 \text{ (ft)}$$

42) CUBIC FOOT PER FOOT OF DEPTH (CYLINDRICAL TANKS)

$$\text{CU. FT.} = 0.7854 * D^2 \text{ (ft)}$$

43) CUBIC FOOT PER INCH OF DEPTH (CYLINDRICAL TANKS)

$$\text{CU. FT.} = 0.06545 * D^2 \text{ (ft)}$$

FORMULAS FOR SQUARE TANKS

44) BBLS PER INCH

$$\text{BBLs} = 0.0001031 * L (\text{in}) * W (\text{in})$$

45) GALLONS PER INCH

$$\text{GALLONS} = 0.004329 * L (\text{in}) * W (\text{in})$$

46) CUBIC FOOT PER INCH

$$\text{CU. FT.} = 0.005787 * L(\text{in}) * W (\text{in})$$

#### FORMULAS FOR PIPE LINES

47) BBLs. PER FOOT

$$= 0.0009714 * D^2$$

48) LINEAR FT. PER BBL

$$= \frac{1029.4}{D^2}$$

49) GALLONS PER LINEAR FOOT

$$= 0.0408 * D^2$$

50) LINEAR FOOT PER GALLON

$$= \frac{183.35}{D^2}$$

51) CUBIC FOOT PER LINEAL FOOT

$$= 0.005454 * D^2$$

52) BBLs TO FILL HOLE (RULE OF THUMB)

$$\frac{\text{PIPE WT.} * 0.002 * \text{DEPTH}}{5.6}$$

53) GALLONS PER MINUTE FOR PDC BITS

$$= 12.72 * \text{BIT DIAMETER} * 1.47$$