



Acronyms used in the following formulas are defined in the WellSharp Acronyms document, available on the secure Provider Resources webpage. For instructions on rounding numbers when making calculations, refer to the following rounding rules and recommendations. Carry the rounded values forward into subsequent calculations.

ROUNDING RULES

- When calculating Kill Mud Weight, **ROUND UP** to two decimal places (for example: round up 1.212 kg/m³ to 1.22 kg/m³; round up 1.463 kg/m³ to 1.47 kg/m³).
- When calculating Leak Off Test Equivalent Mud Weight, **ROUND DOWN** to two decimal places (for example: round down 1.408 kg/m³ to 1.40 kg/m³; round down 1.614 kg/m³ to 1.61 kg/m³).
- When calculating Pressure Reduction Schedule, **ROUND DOWN** to a whole number (for example: round down 1.33 kPa/100 stks to 1.3 kPa/100 stks).
- If the Kill Mud Weight or Leak Off values are to be used in subsequent calculations, use the rounded value in the future calculation. Do not use the unrounded calculated value.

ROUNDING RECOMMENDATIONS

See Table to right where:

X= Whole number

X.XXXX = Number with 4 decimal places

MEASUREMENT	UNITS	ROUNDING and ANSWER FORMAT
Depth	Meters	X. X
Pressure	kPa	X
Pressure Gradient	kPa/meter	X.X
Mud Weight	kg/m ³	X.XX
Volume	m ³	X.XX
Capacity and Displacement	m ³ /meter	X.XXX
Pump Speed in strokes per minute	SPM	X
Strokes	stk or stks	X
Speed in meters per hour	meters/hour	X.X
Area	cm ²	X.XX
Weight	kg	X
Force	decaNewtons (daN)	X
Wait and Weight Pressure Reduction Schedule	kPa/100 stks or kPa/10 steps*	X.XX

* 10 steps = Surface to Bit strokes divided by 10.

1. FORCE IN DECANEWTONS (*daN*) = Pressure _{kPa} x Area _{cm²} ÷ 100
2. PRESSURE (*kPa*) = Force _{dcN} ÷ Area _{cm²} x 100
3. TUBULAR CAPACITY (*m³/meter*) = $ID_{mm}^2 \div 1273236$ (*ID = Internal Diameter of Tubular in millimeters*)
4. ANNULAR CAPACITY (*m³/meter*) = $(D_{mm}^2 - d_{mm}^2) \div 1273236$ (*D = Hole Diameter or Casing ID d = Outside Diameter of Tubular*)
5. HEIGHT OF FLUID IN A PIPE OR ANNULUS (*meters*) = Kick Volume _{m³} ÷ Annular Capacity _{m³/meter} or Pipe Capacity _{m³/meter}
6. HYDROSTATIC PRESSURE (*kPa*) = Mud Weight _{kg/m³} x 0.00981 x TVD _{meters}
7. HYDROSTATIC PRESSURE GRADIENT (*kPa/meter*) = Mud Weight _{kg/m³} x 0.00981
8. FORMATION PRESSURE (*kPa*) = Hydrostatic Pressure in Drill String _{kPa} + SIDPP _{kPa}
9. MUD WEIGHT (*kg/m³*) = Pressure Gradient _{kPa/meter} ÷ 0.00981 or Pressure _{kPa} ÷ TVD _{meters} ÷ 0.00981
10. EQUIVALENT MUD WEIGHT (*kg/m³*) = Pressure _{kPa} ÷ 0.00981 ÷ TVD _{meters}
or (Surface Pressure _{kPa} ÷ TVD _{meters} ÷ 0.00981) + Mud Weight _{kg/m³}
11. EQUIVALENT CIRCULATING DENSITY (*kg/m³*) = (Annular Pressure Loss _{kPa} ÷ 0.00981 ÷ TVD _{meters}) + Original Mud Weight _{kg/m³}
12. KILL WEIGHT MUD (*kg/m³*) = (SIDPP _{kPa} ÷ 0.00981 ÷ TVD _{meters}) + Original Mud Weight _{kg/m³}
13. INITIAL CIRCULATING PRESSURE (*kPa*) = Slow Circulating Rate Pressure _{kPa} + SIDPP _{kPa}
14. FINAL CIRCULATING PRESSURE (*kPa*) = Slow Circulating Rate Pressure _{kPa} x (Kill Mud Weight _{kg/m³} ÷ Original Mud Weight _{kg/m³})
15. NEW PUMP PRESSURE WITH NEW SPM (*kPa*) = Current Pressure _{kPa} x (New SPM ÷ Old SPM)² (***only approximate!***)

16. NEW PUMP PRESSURE WITH NEW MUD WEIGHT (kPa) = Current Pressure kPa x (New Mud Weight \div Old Mud Weight) *(only approximate!)*

17. MAXIMUM ALLOWABLE MUD WEIGHT (kg/m^3) = (Surface Leak Off $kPa \div 0.00981 \div$ Shoe TVD meters) + Test Mud Weight kg/m^3
(Fracture Mud Weight)

18. MAASP or MACP (kPa) = (Maximum Allowable Mud Weight kg/m^3 - Current Mud Weight kg/m^3) x 0.00981 x Shoe TVD meters

19. NEW MAASP AFTER KILL (kPa) = (Maximum Allowable Mud Weight kg/m^3 - Kill Mud Weight kg/m^3) x 0.00981 x Shoe TVD meters

20. ADDITIONAL MUD RETURNED BY SLUG (m^3) = [(Slug Weight $kg/m^3 \div$ Mud Weight kg/m^3) - 1] x Slug Volume m^3

21. TOTAL MUD RETURNED BY SLUG (m^3) = (Slug Weight $kg/m^3 \div$ Mud Weight kg/m^3) x Slug Volume m^3

22. LEVEL DROP AFTER PUMPING A SLUG (m^3) = [(Slug Weight $kg/m^3 \div$ Mud Weight kg/m^3) - 1] x Slug Volume $m^3 \div$ Drill Pipe Capacity $m^3/meter$

23. RISER MARGIN (kg/m^3) = [(Riser Mud Hydrostatic kPa - Seawater Hydrostatic kPa) \div 0.00981] \div (Well TVD m - Water Depth m - Air Gap m)

24. CASING PRESSURE AFTER SUBSEA START-UP (kPa) = Shut-In Casing Pressure kPa - Choke Line Friction Loss kPa

25. BOYLES LAW FORMULAE $P_1 \times V_1 = P_2 \times V_2$ $P_2 = \frac{P_1 \times V_1}{V_2}$ $V_2 = \frac{P_1 \times V_1}{P_2}$ *Atmospheric Pressure = 101.3 kPa*
P = Pressure: V = Volume

26. GAS MIGRATION RATE ($meters/hour$) = Shut-In Pressure Increase $kPa/hour \div$ Mud Gradient $kPa/meter$ *(can use SIDPP or SICP)*
(Increase over last hour)

27. VOLUME TO BLEED DUE TO GAS MIGRATION (m^3) = (Working Pressure to Bleed $kPa \div$ Mud Gradient $kPa/meter$) x Annular Capacity $m^3/meter$
(For Volumetric Method)

WELL COMPLETION/WORKOVER FORMULA SHEET—FIELD UNITS

1. KILL FLUID WEIGHT (kg/m^3) = (SITP $kPa \div$ Top Perforations TVD $meters \div$ 0.00981) + Original Fluid Weight kg/m^3
2. KILL FLUID WEIGHT (kg/m^3) = BHP $kPa \div$ TVD $meters \div$ 0.00981

BULLHEADING FORMULAE

3. FORMATION FRACTURE PRESSURE (kPa) = Formation Fracture Gradient $kPa/meter \times$ Top Perforations TVD $meters$
4. INITIAL HYDROSTATIC PRESSURE (kPa) = Formation Pressure kPa - SITP kPa
5. INITIAL AVERAGE FLUID DENSITY (kg/l) = Initial Hydrostatic Pressure $kPa \div$ Top Perforations TVD $meters \div$ 0.00981
6. MAX INITIAL SURFACE PRESSURE (kPa) = Formation Fracture Pressure kPa - Initial Hydrostatic Pressure kPa
7. MAX FINAL SURFACE PRESSURE (kPa) = Formation Fracture Pressure kPa - (Kill Fluid Weight $kg/m^3 \times$ 0.00981 \times Top Perforations TVD $meters$)
8. VOLUME TO BULLHEAD (m^3) = Surface Lines m^3 + Surface to EOT m^3 + EOT to Top Perfs m^3 + Top Perfs to Bottom Perfs m^3
{EOT = End of Tubing Perfs = Perforations}
9. BULLHEAD SPM TO EXCEED GAS MIGRATION = Gas Migration Rate $m^3/hour \div$ 60 \times Tubing Capacity $m^3/meter \div$ Pump Output $m^3/stroke$

TEMPERATURE CORRECTION FORMULA FOR BRINES

10. FLUID DENSITY TO MIX (kg/m^3) = Fluid Density at Avg. Temp $kg/m^3 + [(Avg. Temp C - Surface Temp C) \times Weight Loss kg/m^3/degree C]$
{AVG = Average C = degrees Centigrade}

Example Weight Loss Chart

(Note: Values will vary based on type of fluid and other factors.)

Brine weight (kg/m^3)	Weight loss ($kg/m^3/^\circ C$)
1000.0 – 1080.0	0.37
1090.0 – 1320.0	0.54
1330.0 – 1740.0	0.71
1750.0 – 2040.0	0.86
2050.0 – 2300.0	1.04