

Useful Calculations and Conversion Factors

Official Metric Equivalents (according to U.S. and Canadian law):

$$1 \text{ inch (in.)} = 25.4 \text{ millimeters (mm)}$$

$$1 \text{ pound (lb.)} = 453.59237 \text{ grams (g)}$$

Useful Conversion Factors:

Distance:	feet (ft)	x	0.3048	=	meters (m)
	meters	x	3.2808	=	feet
Weight:	pounds (lbs)	x	0.4536	=	kilograms (kg)
	kilograms	x	2.2026	=	pounds
Peak Particle Velocity:	in/sec	x	25.4	=	mm/sec
	mm/sec	x	0.3937	=	in/sec
Volume:	cubic yards (yd ³)	x	1.308	=	cubic meters (m ³)
	cubic meters	x	0.7645	=	cubic yards
Powder Factor:	lbs/yd ³	x	0.93	=	kg/m ³
	kg/m ³	x	1.6863	=	lbs/yd ³
Square Root Scaled Distance:	ft/lbs ^{1/2}	x	0.45236	=	m/kg ^{1/2}
	m/kg ^{1/2}	x	2.2106	=	ft/lbs ^{1/2}
Cube Root Scaled Distance:	ft/lbs ^{1/3}	x	0.3965	=	m/kg ^{1/3}
	m/kg ^{1/3}	x	2.5221	=	ft/lbs ^{1/3}
Pressure:	lbs/in ²	x	0.145	=	Pascals
	Pascals	x	6.895	=	lbs/in ²
	lbs/in ²	x	.0000689	=	kilobars*
	kilobars*	x	14504	=	lbs/in ²
	feet of water	x	0.434	=	lbs/in ²
	lbs/in ²	x	2.31	=	feet of water

* 1 Bar = 14.5 lbs/in²

Other miscellaneous calculations:

$$\text{Pounds of explosive loading per foot of borehole} = D^2 \times \text{S.G.} \times 0.34^*$$

Where: **D** = explosive diameter

S.G. = specific gravity (g/cc) of explosive

* In the above formula, the factor **0.34** is derived from the equation,

$$\frac{0.7854 \times 12 \times 62.4}{1728}$$

where: 0.7854 = $\frac{1}{4}$ of pi
12 = inches per foot
62.4 = weight of 1 cu ft of water in lbs (at about 45°F)
1728 = cubic inches per cubic foot

$$\text{Displacement of water in a borehole: } H = D^2 / (D^2 - D_e^2) \times h$$

Where: **H** = final height of water

h = initial height of water

D = hole diameter

D_e = explosive cartridge diameter

Determine **H**, the final height of water, and then divide **H** by the cartridge length to determine the number of cartridges that will be required to build out of the water.

$$\text{Square Root Scaled Distance (D}_s\text{)} = \text{Distance} / \text{Explosive Weight}^{1/2}$$

$$\text{Cube Root Scaled Distance (D}_s\text{)} = \text{Distance} / \text{Explosive Weight}^{1/3}$$

The following equations express the relationships between **Velocity**, **Displacement**, **Frequency** and **Acceleration** for sinusoidal waveforms:

$$V = 2 \pi f D \quad \text{or} \quad V = 386.1 \text{ Gs} / (2 \pi f)$$

$$D = V / (2 \pi f)$$

$$A = 2 \pi f V \quad \text{or} \quad A_g = (2 \pi f V) / 386.1$$

$$f = V / (2 \pi D) \quad \text{or} \quad f = A / (2 \pi V)$$

Where: V = velocity in inches/second

D = peak displacement in inches

A = acceleration in in/second/second (in/sec²)

A_g = acceleration in Gs

f = frequency in Hertz (cycles per second)

π (pi) = 3.14159....

Cole's formula for determining peak pressure from an explosive charge detonating underwater (assumed TNT or equivalent):

$$P = 2.25 \times 10^4 (W^{1/3} / R)^{1.14}$$

Where:

P = peak pressure in psi

W = explosive charge weight in pounds

R = distance in feet from the detonating charge

(courtesy of the Golden West Chapter of the ISEE)