

## Appendix B Metric Charge Calculations

**B-1. Equivalent Metric Weights for Standard Explosives.** NATO requirements make metric conversions necessary. The following formulas are metric equivalents for charge calculations. Table B-1 lists the metric equivalents for standard US Army demolition charges.

**Table B-1. Standard US demolition charges (metric equivalents)**

Explosive	Unit (Pounds)	Detonation Velocity		RE Factor	Weight (Metric) (Kilograms)
		M/Sec	Ft/Sec		
TNT	0.25	6,900	22,600	1.00	0.113
	0.50	6,900	22,600	1.00	0.227
	1.00	6,900	22,600	1.00	0.454
M2 Tetrytol	2.50	7,000	22,900	1.20	1.134
M3 Comp C2 or C3	2.25	7,625	25,000	1.34	1.021
M5A1 Comp C4	2.50	8,040	26,400	1.34	1.134
M112 Block (C4)	1.25	8,040	26,400	1.34	0.567
M118 Block (PETN)	2.00	7,040	23,600	1.14	0.907
M118 Sheet (PETN)	0.25	7,040	23,600	1.14	0.113
M186 Roll (PETN)	25.00	7,040	23,600	1.14	11.34
Ammonium Nitrate	43.00	3,400	11,000	0.42	18.14
M1 Dynamite	0.50	6,100	20,000	0.92	0.227
M2A4 Shaped Charge	15.00	NA	NA	NA	6.80
M3A1 Shaped Charge	40.00	NA	NA	NA	18.14
M183 Assembly	NA	NA	NA	1.34	9.07

**B-2. Timber-Cutting Formulas.** The formulas on the following pages are examples of charge calculations converted to their metric equivalents.

a. *Tamped Internal Charges.*

$$K = \frac{D^2}{3,500} \quad (B-1)$$

where—

*K* = TNT required, in kilograms.*D* = timber diameter, in centimeters.b. *Untamped External Charges.*

$$K = \frac{D^2}{560} \quad (B-2)$$

where—

*K* = TNT required, in kilograms.*D* = timber diameter, in centimeters.c. *Abatis Charges.*

$$K = \frac{D^2}{700} \quad (B-3)$$

where—

*K* = TNT required, in kilograms.*D* = timber diameter, in centimeter.

**B-3. Steel-Cutting Formulas.** Table B-2 gives the correct metric weight of TNT necessary to cut structural steel sections of various dimensions. Use Table B-2 or use the following formulas:

a. *Structural Steel.*

$$K = \frac{A}{38} \quad (B-4)$$

where—

*K* = TNT required, in kilograms.*A* = cross-sectional area of the steel, in square centimeters.b. *Other Steel.*

$$K = \frac{D^2}{14} \quad (B-5)$$

where—

*K* = TNT required, in kilograms.*D* = section diameter, in centimeters.

Table B-2. TNT steel-cutting charges (metric)

Average Section Thickness (cm)	Section Width (cm)											
	4	6	8	10	15	20	25	30	35	40	50	60
0.5	0.06	0.08	0.11	0.13	0.20	0.27	0.33	0.40	0.46	0.53	0.66	0.79
1.0	0.11	0.16	0.21	0.27	0.40	0.53	0.66	0.79	0.93	1.06	1.32	1.58
1.5	0.16	0.24	0.32	0.40	0.60	0.79	0.99	1.19	1.39	1.58	1.98	2.37
2.0	0.21	0.32	0.42	0.53	0.79	1.06	1.32	1.58	1.85	2.11	2.64	3.16
2.5	0.27	0.40	0.53	0.66	0.99	1.32	1.65	1.98	2.31	2.64	3.29	3.95
3.0	0.32	0.48	0.64	0.79	1.19	1.58	1.98	2.37	2.77	3.16	3.95	4.74
3.5	0.37	0.56	0.74	0.93	1.39	1.85	2.31	2.77	3.23	3.69	4.61	5.53

**B-4. Pressure Charges for T-Beams.** Use the following formula to determine the metric size of T-beam pressure charges:

$$K = 48HT \quad (B-6)$$

where—

*K* = TNT required, in kilograms.

*H* = T-beam height, in meters.

*T* = beam thickness, in meters.

**NOTE:** Measure *H* and *T* to the nearest 0.1 meter, but no less than 0.3 meter. Minimum tamping required is 30 centimeters. Increase *K* by one third for untamped charges.

**B-5. Breaching Charges.**

$$K = R^3MC \quad (B-7)$$

where—

*K* = TNT required, in kilograms.

*R* = breaching radius, in meters (Chapter 3, page 3-17).

*M* = material factor (Table B-3, page B-4).

*C* = tamping factor (Figure 3-16, page 3-19).

a. **Breaching Radius.** The breaching radius is the distance a charge must penetrate to displace or destroy the target. For example, to determine the breaching radius for a 2.9-meter concrete wall with a charge placed on its side, use 3.0 as the breaching radius in the formula above. Always round the target's depth to the next higher quarter meter (2.9 becomes 3.0, 2.54 becomes 2.75, and so forth).

b. **Material Factor.** Table B-3 (page B-4) lists material factors.

c. *Tamping Factor*. The value of the tamping factor depends on the location and tamping of the charge. A charge is not adequately tamped unless the tamping material's depth equals or exceeds the breaching radius. Figure 3-16 (page 3-19) gives values for the tamping factor.

**Table B-3. Material factors (*M*) for breaching charges (metric)**

<b>Material</b>	<b>Breaching Radius (<i>R</i>)</b>	<b><i>M</i></b>
Earth	All values	1.12
Poor masonry Shale Hardpan Good timber Earth construction	Less than 1.5 m  1.5 m or more	5.13  4.64
Good masonry Concrete block Rock	0.3 m or less Over 0.3 m to less than 1 m 1 m to less than 1.5 m 1.5 m to less than 2 m 2 m or more	14.09 7.69 6.41 5.13 4.32
Dense concrete First-class masonry	0.3 m or less Over 0.3 m to less than 1 m 1 m to less than 1.5 m 1.5 m to less than 2 m 2 m or more	18.26 9.93 8.33 6.57 5.61
Reinforced concrete (Factor does not consider cutting of concrete)	0.3 m or less Over 0.3 m to less than 1 m 1 m to less than 1.5 m 1.5 m to less than 2 m 2 m or more	28.19 15.38 12.81 10.09 8.65