Corrosion Rate Calculation Guide

Standardized ASTM G1 methodology using Metric (European) and US Customary (Imperial) units

Weight loss corrosion coupons provide a direct, reliable measurement of average corrosion rates over a known exposure period. Under **ASTM G1**, the uniform corrosion rate is calculated from the mass lost during exposure, the alloy density, the exposed surface area, and the total exposure time.

1. General ASTM G1 Formula & Unit Conversion Constants

Because engineering teams work with both metric and US customary measurements, the ASTM G1 equation incorporates a conversion constant (**K**) tailored to your selected input and output units:

$$\text{Corrosion Rate} = \frac{K \times W}{D \times A \times T}$$

W = weight loss | **D** = alloy density | **A** = exposed surface area
T = exposure time (hours) | **K** = unit conversion constant

Unit System	Output Unit	Weight Loss (W)	Density (D)	Area (A)	Time (T)	Constant (K)
Metric (mm²)	**mm/year**	mg	g/cm³	mm²	hours	**8,760**
Metric (cm²)	**mm/year**	mg	g/cm³	cm²	hours	**87.6**
Standard ASTM (Mixed)	**mpy** (mils/year)	mg	g/cm³	in²	hours	**534**
US Customary (lb/in³)	**mpy** (mils/year)	mg	lb/in³	in²	hours	**19.31**
US Customary (lb/ft³)	**mpy** (mils/year)	mg	lb/ft³	in²	hours	**33,368**

Practical note on mixed units: Combining density in **g/cm³** with surface area in **in²** is standard industry practice because alloy densities are universally published in g/cm³ while standard coupon sizes are often specified in inches.

2. Worked Examples (Carbon Steel Coupon)

All four examples below evaluate the exact same carbon steel coupon test: **30 days** exposure (**T = 720 hours**), measured weight loss **W = 125 mg**, and a surface area of **3.5 in²** (equivalent to **2,258 mm²** or **22.58 cm²**).

Example A — Full Metric Calculation (mm² to mm/year)

EUROPEAN / METRIC STANDARD

Given: W = 125 mg | D = 7.86 g/cm³ | A = 2,258 mm² (3.5 in² × 645.16) | T = 720 hours | K = 8,760

$$\text{mm/year} = \frac{8{,}760 \times 125}{7.86 \times 2{,}258 \times 720} = \frac{1{,}095{,}000}{12{,}778{,}022.4} \approx \mathbf{0.0857\ mm/year}$$

*Note: Using the unrounded surface area of 2,258.06 mm² (or 22.58 cm² with K = 87.6) yields **0.0856 mm/year**.*

Example B — Standard ASTM G1 Mixed-Unit Calculation (in² & g/cm³ to mpy)

GLOBAL INDUSTRY STANDARD

Given: W = 125 mg | D = 7.86 g/cm³ | A = 3.5 in² | T = 720 hours | K = 534

$$\text{mpy} = \frac{534 \times 125}{7.86 \times 3.5 \times 720} = \frac{66{,}750}{19{,}807.2} \approx \mathbf{3.37\ mpy} \quad (3.37 \times 0.0254 = \mathbf{0.0856\ mm/year})$$

Example C — Full US Customary Calculation (in² & lb/in³ to mpy)

IMPERIAL / US DENSITY

Given: W = 125 mg | D = 0.284 lb/in³ (7.86 g/cm³ × 0.036127) | A = 3.5 in² | T = 720 hours | K = 19.31

$$\text{mpy} = \frac{19.31 \times 125}{0.284 \times 3.5 \times 720} = \frac{2{,}413.75}{715.68} \approx \mathbf{3.37\ mpy}$$

Example D — US Customary Calculation with lb/ft³ (in² & lb/ft³ to mpy)

IMPERIAL / CUBIC FOOT DENSITY

Given: W = 125 mg | D = 490.7 lb/ft³ (7.86 g/cm³ × 62.428) | A = 3.5 in² | T = 720 hours | K = 33,368

$$\text{mpy} = \frac{33{,}368 \times 125}{490.7 \times 3.5 \times 720} = \frac{4{,}171{,}000}{1{,}236{,}564} \approx \mathbf{3.37\ mpy}$$

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