Corrosion Rate Converter: mm/a, mpy, mdd and Current Density

Converts a uniform corrosion rate between penetration (mm/a, mil/a), mass loss (g/m²·d, mdd) and equivalent corrosion current density from density and valence.

Method: Corrosion rate unit relations with Faraday's law

Input parameters

Unit system: SI

Parameter	Value	Unit
Corrosion rate	0.10000	mm/a
Metal density	7,870.0	kg/m³
Molar mass	55.845	kg/kmol
Electrons per atom	2.0000	

Calculated results

Parameter	Value	Unit
Penetration rate (mm/a)	0.10000	mm/a
Penetration rate (mpy)	3.9370	mil/a
Penetration rate (µm/a)	100.00	µm/a
Mass loss rate	2.1547	g/(m²·d)
Mass loss rate (mdd)	21.547	mg/(dm²·d)
Corrosion current density	86.174	mA/m²

Notes for this case

• Mass loss per area = penetration rate × density; current density = mass loss × nF/M by Faraday's law. 1 mm/a = 39.37 mpy; for steel 1 mm/a ≈ 21.6 g/m²·d ≈ 216 mdd ≈ 86 µA/cm². Valid for uniform corrosion; pitting rates must be judged by depth, not mass loss.

Formula and method

$$\dot{m}'' = CR \cdot \rho, \quad i_{corr} = \frac{\dot{m}'' n F}{M}$$

Variables

CR	Corrosion rate	m/s
ρ	Metal density	kg/m³
M	Molar mass	kg/kmol
n	Electrons per atom	-
$\dot{m}''$	Mass loss rate	kg/(m²·s)
i_{corr}	Corrosion current density	A/m²

Method and standards

Rate conversion.

Assumptions and limits

- Uniform corrosion; single dissolving species.

References

Corrosion rate unit relations with Faraday's law

Report details

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Software release	FireCAD Calc, release of 22 November 2026
Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/materials/corrosion/corrosion-rate-unit-converter

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.