Corrosion Rate from Current Density (Faraday)

Uniform corrosion rate in mm per year and mass loss from a corrosion current density by Faraday's law, from the metal's molar mass, valence and density.

Method: Faraday's law: mass loss = i M/(n F); penetration = mass loss/ρ (as in ASTM G102)

Input parameters

Unit system: SI

Parameter	Value	Unit
Corrosion current density	0.10000	A/m²
Molar mass of the metal	55.845	kg/kmol
Electrons per atom (valence)	2.0000	
Metal density	7,870.0	kg/m³

Calculated results

Parameter	Value	Unit
Corrosion rate	0.11604	mm/a
Mass loss rate	2.5004	g/(m²·d)

Formula and method

$$\dot{m}'' = \frac{iM}{nF}, \quad CR = \frac{\dot{m}''}{\rho}$$

Variables

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

Method and standards

Faraday's law.

Assumptions and limits

- Uniform corrosion.

References

- Faraday's law: mass loss = i M/(n F); penetration = mass loss/ρ (as in ASTM G102)

Report details

Report reference	FCC-KS97-KC15 (the same inputs always give the same reference)
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Calculator	Corrosion Rate from Current Density (Faraday)
Method last reviewed	12 November 2026
Software release	FireCAD Calc, release of 17 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/faraday-corrosion-rate

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.