Sliding Wear Volume (Archard Equation)

Wear volume, depth and mass lost by sliding contact from load, sliding distance, hardness and a dimensionless wear coefficient, by the Archard equation.

Method: Archard wear law

Input parameters

Unit system: SI

Parameter	Value	Unit
Dimensionless wear coefficient	1.0000e-04	
Normal load	0.20000	kN
Sliding distance	5,000.0	m
Hardness of the softer surface	1,500.0	MPa
Apparent (nominal) contact area	100.00	mm²
Density of the worn material	7,850.0	kg/m³

Calculated results

Parameter	Value	Unit
Wear volume	66.667	mm³
Wear depth over the contact area	0.66667	mm
Mass lost	0.52333	g
Specific wear rate K/H (mm³/N·m)	6.6667e-05	

Notes for this case

• Archard's law states that wear volume is proportional to load and sliding distance and inversely proportional to the hardness of the softer surface: V = KF_Ns/H. K ranges from about 10^{-8} for lubricated, mild wear to 10^{-2} for severe adhesive wear of clean metals, so it must come from tests on the actual pair. The specific wear rate k = K/H (mm³/N·m) is what pin-on-disc tests usually report. Depth assumes the wear spreads evenly over the nominal area.

Formula and method

$$V = \frac{K F_N s}{H}, \quad h_w = \frac{V}{A}, \quad k = \frac{K}{H}$$

Variables

K	Dimensionless wear coefficient	-
F_N	Normal load	N
s	Sliding distance	m
H	Hardness of the softer surface	Pa
A	Apparent (nominal) contact area	m²
ρ	Density of the worn material	kg/m³
V	Wear volume	m³
h_w	Wear depth over the contact area	m
Δm	Mass lost	kg
k	Specific wear rate K/H (mm³/N·m)	-

Method and standards

Archard wear.

Assumptions and limits

- Steady-state wear; constant K; uniform wear over the contact.

References

Archard wear law

Report details

Report reference	FCC-ZG3S-2HAE (the same inputs always give the same reference)
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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/properties/archard-wear-volume

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.