Sacrificial Anode Resistance and Current Output (Dwight)

Resistance to earth of a vertical cylindrical anode by Dwight's formula, its current output for the driving voltage and the number of anodes for a current demand.

Method: Dwight's resistance of a vertical rod

Input parameters

Unit system: SI

Parameter	Value	Unit
Soil or water resistivity	2.0000e+07	Ω·mm²/m
Anode (or backfill column) length	1.5000	m
Anode (or backfill column) diameter	200.00	mm
Driving voltage (anode to protected structure)	0.70000	V
Total protection current required	0.60000	A

Calculated results

Parameter	Value	Unit
Anode resistance to earth	6.5664	Ω
Current output per anode	0.10660	A
Anodes needed (rounded up)	6.0000	

Notes for this case

• Dwight's formula for a vertical rod of length L and diameter d in uniform earth is R = ρ/(2πL)[ln(8L/d) − 1]. With backfill of much lower resistivity, use the backfill column's dimensions. The anode delivers I = ΔV/R, where ΔV is the difference between the anode's closed-circuit potential and the structure's protected potential: about 0.25 V for zinc, 0.3 V for aluminium and 0.65–0.9 V for magnesium against −0.85 V CSE. Anodes in a group interfere, so a group needs more anodes than this simple division.

Formula and method

$$R_a = \frac{\rho}{2\pi L}\left[\ln\frac{8L}{d} - 1\right], \quad I_a = \frac{\Delta V}{R_a}$$

Variables

ρ	Soil or water resistivity	Ω·m
L	Anode (or backfill column) length	m
d	Anode (or backfill column) diameter	m
ΔV	Driving voltage (anode to protected structure)	V
I_{req}	Total protection current required	A
R_a	Anode resistance to earth	Ω
I_a	Current output per anode	A
N	Anodes needed (rounded up)	-

Method and standards

Anode resistance.

Assumptions and limits

- Single vertical anode in uniform resistivity; top at the surface neglected.

References

Dwight's resistance of a vertical rod

Report details

Report reference	FCC-6EC0-6M61 (the same inputs always give the same reference)
Generated	23 November 2026, 18:18 UTC
Calculator	Sacrificial Anode Resistance and Current Output (Dwight)
Method last reviewed	17 November 2026
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/sacrificial-anode-resistance-dwight

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.