Electrical Conductivity, %IACS and Resistivity at Temperature

Converts a metal's resistivity at 20 °C to conductivity and %IACS, and corrects resistivity and conductivity to another temperature with its coefficient.

Method: International Annealed Copper Standard and linear temperature coefficient

Input parameters

Unit system: SI

Parameter	Value	Unit
Resistivity at 20 °C	2.8260	µΩ·cm
Temperature coefficient at 20 °C (1/K)	0.004030	
Temperature	90.000	°C

Calculated results

Parameter	Value	Unit
Conductivity at 20 °C	3.5386e+07	S/m
Conductivity as % IACS	61.008	
Resistivity at T	3.6232	µΩ·cm
Conductivity at T	2.7600e+07	S/m
Resistance ratio	1.2821	

Notes for this case

• The International Annealed Copper Standard (1913) defines 100 % IACS as a resistivity of 1/58 Ω·mm²/m (1.7241 µΩ·cm) at 20 °C. Conductivity is the reciprocal of resistivity. Over moderate ranges resistivity varies linearly, ρ_T = ρ₂₀[1 + α₂₀(T − 20 °C)], with α₂₀ = 0.00393/K for annealed copper and 0.00403/K for EC aluminium. Modern pure copper reaches about 101–102 % IACS; aluminium about 61 %.

Formula and method

$$\%IACS = 100\frac{1.7241\,\mu\Omega\,\mathrm{cm}}{\rho_{20}}, \quad \rho_T = \rho_{20}[1+\alpha_{20}(T-20\,^\circ\mathrm{C})]$$

Variables

ρ_{20}	Resistivity at 20 °C	Ω·m
α_{20}	Temperature coefficient at 20 °C (1/K)	-
T	Temperature	K
σ_{20}	Conductivity at 20 °C	S/m
$\%IACS$	Conductivity as % IACS	-
ρ_T	Resistivity at T	Ω·m
σ_T	Conductivity at T	S/m
R_T/R_{20}	Resistance ratio	-

Method and standards

IACS conversion.

Assumptions and limits

- Volume conductivity; linear temperature law.

References

International Annealed Copper Standard and linear temperature coefficient

Report details

Report reference	FCC-DGXC-K64P (the same inputs always give the same reference)
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Calculator	Electrical Conductivity, %IACS and Resistivity at Temperature
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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/electrical-conductivity-iacs

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.