Winding Temperature Rise by the Resistance Method

Average winding temperature and temperature rise from cold and hot winding resistances, for copper or aluminium, as in transformer and motor heat-run tests.

Method: Resistance method of temperature rise

Input parameters

Unit system: SI

Parameter	Value	Unit
Conductor material	Copper (k = 234.5)	
Cold resistance	0.45200	Ω
Winding temperature at cold measurement	20.000	°C
Hot resistance at shutdown	0.57100	Ω
Cooling medium temperature at the end of the test	30.000	°C

Calculated results

Parameter	Value	Unit
Average hot winding temperature	87.003	°C
Winding temperature rise	57.003	K
Resistance ratio	1.2633	

Notes for this case

• $T_2 = (R_2/R_1)(T_1 + k) - k$ (°C), with k = 234.5 for copper and 225 for aluminium, the inferred zero-resistance temperatures. The hot resistance is extrapolated back to the instant of shutdown from readings taken as the winding cools. The result is the average winding temperature; the hot spot is higher.

Formula and method

$$T_2 = \frac{R_2}{R_1}(T_1 + k) - k, \quad \Delta T_w = T_2 - T_a$$

Variables

$\mathrm{conductor}$	Conductor material	-
R_1	Cold resistance	Ω
T_1	Winding temperature at cold measurement	K
R_2	Hot resistance at shutdown	Ω
T_a	Cooling medium temperature at the end of the test	K
T_2	Average hot winding temperature	K
ΔT_w	Winding temperature rise	K
R_2/R_1	Resistance ratio	-

Method and standards

Resistance method.

Assumptions and limits

- Uniform winding temperature change; linear resistance-temperature relation.

References

Resistance method of temperature rise

Report details

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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/electrical/transformers/winding-temperature-rise-resistance

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.