Grid Resistors: Determining Nominal Resistance

By Daniel Featherstone

SCENARIO

The customer wants to dissipate 100 V at a rate of 100 A continuously.

$$100\ V \times 100\ A = 10\ kW$$

$$100\ V / 100\ A = 1\ \Omega$$

FACT

Nearly all resistor materials change resistance as temperature increases. Depending on the material, this change can range from a few percent to 50 % and higher at 100 % duty on the resistor (100 % duty raises the resistor temperature to ~ 375 °C over ambient).

In the scenario above, there are two ways to handle the resistor design (assuming a material with a 33 % change in resistance at 100 % power and that the voltage applied across the resistor is constant).

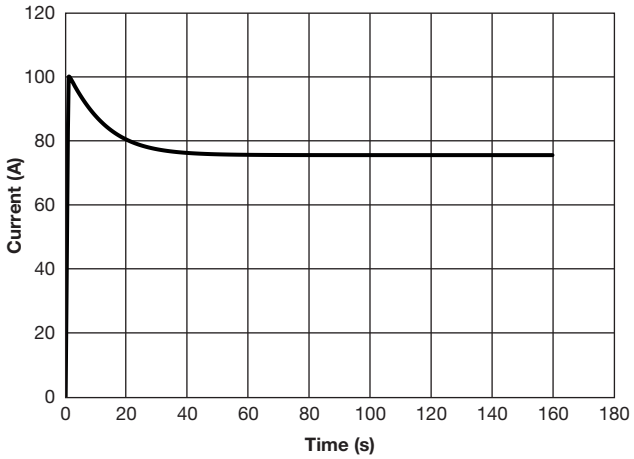
Design 1

Voltage across resistor (cold) = 100 V

Cold resistance (0 % power) = 1 Ω

Initial current (at 1 Ω) = 100 A

Initial power rating = 10 kW

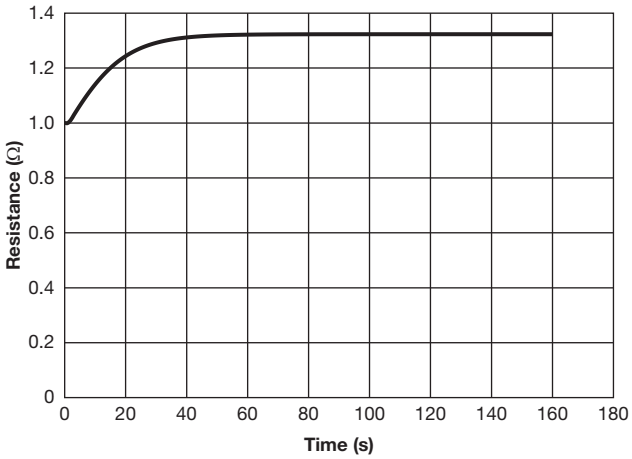


Voltage across resistor (hot) = 100 V

Hot resistance (100 % power) = 1.33 Ω

Hot current (100 % power) = 75.2 A

Continuous duty power rating = 7.52 kW



APPLICATION NOTE

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Design 2

Voltage across resistor (cold) = 100 V

Cold resistance (0 % power) = 0.752 Ω

Initial current (at 10 Ω) = 133 A

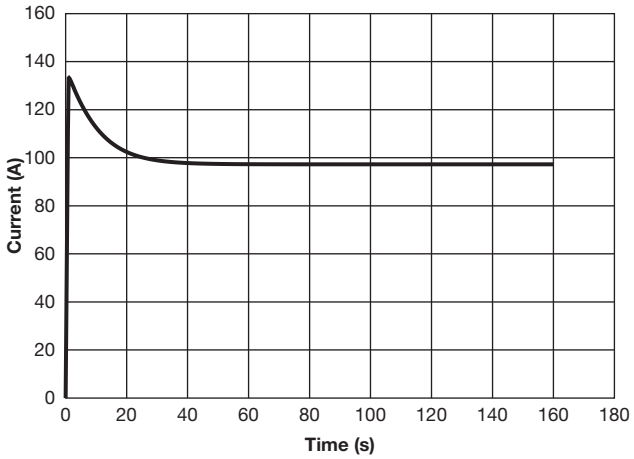
Initial power rating = 13.3 kW

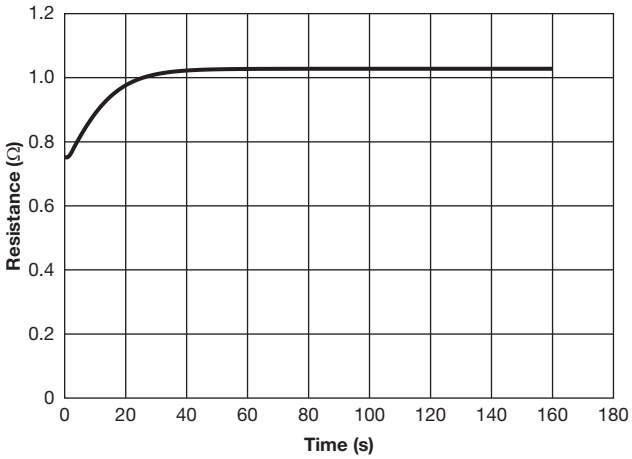
Voltage across resistor (hot) = 100 V

Hot resistance (100 % power) = 1.0 Ω

Hot current (100 % power) = 100 A

Continuous duty power rating = 10 kW





Design 1 is good when there is a desire to limit the current flow.

Design 2 is good when a nominal current flow or power dissipation is desired at the steady state / continuous conditions.

The customer should decide which way they would prefer the resistor be designed based on their application. In the above scenario, Design 2 would likely be better because at continuous duty (100 % power) the resistor will be dissipating the desired power at the desired current rate.

GRE1 datasheet	www.vishay.com/doc?31833
GRE2 Application Form	www.vishay.com/doc?31875
NGR datasheet	www.vishay.com/doc?31873
Load Bank Application Form	www.vishay.com/doc?49893
Dynamic Braking Application Form	www.vishay.com/doc?49887
NGR Application Form	www.vishay.com/doc?49904
Harmonic Filter Application Form	www.vishay.com/doc?49889

APPLICATION NOTE