**Wire size calculation worksheet**

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Wire diameter fit from an AWG table, and the implied wire cross-section

$$d_{wire}(awg) := (0.324861 \cdot in) \cdot e^{-0.115943 \cdot awg}$$

$$a_{wire}(awg) := \frac{\pi}{4} \cdot d_{wire}(awg)^2$$

Density of various wire materials

$$\rho_{cu} := 0.322 \cdot \frac{lb}{in^3} \qquad\qquad \rho_{al} := 0.1 \cdot \frac{lb}{in^3}$$

Conductivity of various wire materials at room temperature:

$$\sigma_{cu} := 58 \cdot 10^6 \cdot \frac{S}{m} \qquad\qquad \sigma_{al} := 0.65 \cdot 58 \cdot 10^6 \cdot \frac{S}{m}$$

Funny unit of wire area used by wire manufacturers:

$$circular\_mil := \frac{\pi}{4} \cdot \left( \frac{in}{1000} \right)^2$$

A wire's area in circular mils is equal to the square its diameter in mils.

Resistance per unit length:

$$R_{wire}(length, awg) := \frac{length}{a_{wire}(awg)\, \sigma_{cu}}$$