

直流導体抵抗計算式

DIRECT CURRENT CONDUCTOR RESISTANCE CALCULATION FORMULA

基本式

$$R = \rho \frac{l}{S}$$

ρ = 体積固有抵抗 (Ω・m)
S = 断面積
l = 長さ

断面積1mm² 長さ1mの標準銅の抵抗

$$R = 0.017241 \Omega$$

$$= \frac{1}{58} \Omega$$

軟銅単線の直流抵抗

$$R = \frac{4 \times 10^3}{58 \pi \sigma d^2} \quad (\Omega / \text{km})$$

σ = 導電率 d = 素線外径 (mm)

撚り線の直流抵抗

(1) 全部同一構造の時

$$R = \frac{4 \times 10^3}{58 \pi \sigma n d^2} (1+S) \quad (\Omega / \text{km})$$

n = 素線数
S = 撚り込み率 $\begin{cases} 60 \text{本以下} & 2\% \\ 60 \text{本以上} & 3\% \end{cases}$

(2) 2種の素線で構成されている時

$$R = \frac{1}{\frac{n_1}{R_1 \sigma_1} + \frac{n_2}{R_2 \sigma_2}} (1+S) \quad (\Omega / \text{km})$$

導電率 σ Conductivity σ

径 (mm) DIAMETER (mm)	軟銅 ANNEALED COPPER WIRE	錫めつき軟銅線 TINNED ANNEALED COPPER WIRE	硬銅 HARD COPPER WIRE
0.10~0.26未満 Less than 0.10 to 0.26	0.98	0.93	—
0.26~0.50未満 Less than 0.26 to 0.50	0.993	0.94	0.96
0.50~2.0未満 Less than 0.50 to 2.0	1.00	0.96	0.96
2.0~8.0未満 Less than 2.0 to 8.0	1.00	0.97	0.97

銅線の抵抗温度係数

定質量抵抗温度係数、銅線の温度による膨張収縮を考慮に入れないで、定質量の或る銅線の抵抗が温度変化に対していかに変化するかを考えたときの温度係数をいいます。いまR_t、R_{t0}をt℃およびt₀℃における銅線の抵抗とすれば次の関係があります。

$$R_t = R_{t0} \{1 + \alpha_{t0} (t - t_0)\}$$

この α_{t0} を定質量温度係数と呼び次の式で表わされます。

$$\alpha_{t0} = \frac{1}{0.00393 \times \sigma} + (t_0 - 20)$$

ただし、σは銅線の導電率
この式から種々の導電率および温度における定質量抵抗温度係数を計算します。

※本カタログの仕様・構成等は性能改善の為、お断り無く変更する場合がございます。
※This specification is subject to change without a prior announcement.

FUNDAMENTAL FORMULA

$$R = \rho \frac{l}{S}$$

ρ = Volume inherent resistance (Ω・m)
S = Sectional area
l = Length

Resistance of standard copper of 1mm² of sectional area and 1m of length

$$R = 0.017241 \Omega$$

$$= \frac{1}{58} \Omega$$

Direct current resistance of annealed single copper wire

$$R = \frac{4 \times 10^3}{58 \pi \sigma d^2} \quad (\Omega / \text{km})$$

σ = Conductivity
d = Outer diameter of element wire

Direct current resistance of stranded wire

(1) At same kind of element wire

$$R = \frac{4 \times 10^3}{58 \pi \sigma n d^2} (1+S) \quad (\Omega / \text{km})$$

n = Number of element wire
S = Stranding rate Less than 60 pieces 2%
More than 60 pieces 3%

(2) When being constituted by 2 kinds of element wires

$$R = \frac{1}{\frac{n_1}{R_1 \sigma_1} + \frac{n_2}{R_2 \sigma_2}} (1+S) \quad (\Omega / \text{km})$$

RESISTANCE TEMPERATURE COEFFICIENT OF COPPER WIRE

The constant mass resistance temperature coefficient is called the temperature coefficient when considering how the resistance of a certain copper wire of constant mass changes against the temperature change, without taking into account the dilation and shrinkage by the temperature of copper wire. Now, when making it as resistance of copper wire at t℃ and t₀℃ for R_t and R_{t0} there is the following relation.

$$R_t = R_{t0} \{1 + \alpha_{t0} (t - t_0)\}$$

This α_{t0} is called the constant mass temperature coefficient, and the following formula is expressed.

$$\alpha_{t0} = \frac{1}{0.00393 \times \sigma} + (t_0 - 20)$$

Where, σ is the conductivity of copper wire.
From this formula each constant mass resistance temperature coefficient in the various dielectric rate and the various temperature is calculated.