RESISTANCE CHARACTERISTICS

Characteristics

The temperature/resistance relationships and tolerances on this page are valid for the sensing resistor at its measuring points. For thermometers they are valid for the complete thermometer at its terminals.

In the case of two-wire connections the resistance values of the leads between the measuring point of the resistor and the terminals must be considered. They may be indicated on the thermometer and must be subtracted from measured values in ohms. In some cases it also may be advisable to consider the temperature coefficient of the leadwires and the temperature distribution along their length.

Temperature/resistance relationships

The temperature/resistance relationships used in this standard are as follows:

for the range of -200°C to 0°C:

$$R_t = R_o[1 + At + Bt^2 + c(t - 100°C)\, t^3]$$

for the range of 0°C to 850°C:

$$R_t = R_o(1 + At + Bt^2)$$

For the quality of platinum commonly used for industrial resistance thermometers, the values of the constants in these equations are:

$A = 3.9083 \times 10^{-3}\ °C^{-1}$ $\qquad$ $C = 4.183 \times 10^{-12}\ °C^{-4}$

$B = 5.775 \times 10^{-7}\ °C^{-2}$ $\qquad$ t = Modulus of temperature without sign

For resistance thermometers satisfying the above relationships, the temperature coefficient is defined as:

$$a = \frac{(R_{100} - R_0)}{100 \times R_0}$$

has the value $0.00385055°C^{-1}$

where

R_{100} is the resistance at 100°C;
R_0 is the resistance at 0°C.

These equations and coefficients are listed as the basis for the temperature / resistance tables in this book. The calibration of individual thermometers will yield different coefficients.

Values of temperatures in this book are based on the International Temperature Scale of 1990 (ITS 90).

Resistance values

Most resistors are constructed to have a nominal resistance of 100Ω. The resistance vs. temperature table is calculated for a resistance of 100.00 Ω at 0°C. For other nominal resistances R_{nom} such as 500 Ω or 1000Ω the table can be used by multiplying the table values with the factor $R_{nom}/100$.

General Requirements (Tolerances)

Sensing resistors

The tolerance values of wirewound resistors are classified in table 1 and the values of film resistors are classified in table 2.

Table 1: Tolerance classes for wound resistors

Tolerance class	Tolerance value (°C)	Temperature range of validity of tolerances
W 0.1	±(0.1°C + 0.0017 [t])	-50°C + 250°C
W 0.15	±(0.15°C + 0.002 [t])	-100°C to 450°C
W 0.3	±(0.3°C + 0.005 [t])	-196°C to 661°C
W 0.6	±(0.6°C + 0.01 [t])	-196°C to 661°C

Table 2: Tolerance classes for film resistors

Tolerance class	Tolerance value (°C)	Temperature range of validity of tolerances
F 0.1	±(0.1°C + 0.0017 [t])	-50°C + 250°C
F 0.15	±(0.15°C + 0.002 [t])	-50°C to 450°C
F 0.3	±(0.3°C + 0.005 [t])	-50°C to 661°C
F 0.6	±(0.6°C + 0.01 [t])	-50°C to 661°C

Table 3: Tolerance classes for thermometers (finished probes)

Tolerance * class	Tolerance values (°C)	
AA	±(0.1 °C + 0.0017 [t])	-50 to 250°C
A	±(0.13°C + 0.0017 [t])	-100 to 450°C
B	±(0.25°C + 0.0042 [t])	-196 to 600°C
C	±(0.6°C + 0.01 [t])	-196 to 600°C

* These tolerances meet or exceed ASTM / IEC thermometer class. They do not necessarily determine the working range of the thermometer.