

# CONSTANTAN®



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Constantan® is a copper-nickel alloy that contains specific minor amounts of additional elements to achieve precise values for the temperature coefficient of resistivity. Careful control of melting and conversion practices results in a very low level of pinholes at ultra-thin thicknesses. The alloy is used extensively for foil resistors and strain gauges.

### AVAILABILITY

Constantan® is available from Hamilton Precision Metals as foil and strip product in thicknesses from 0.0005" to 0.050" (0.0127 mm to 1.27 mm) and in widths up to 12" (304.8 mm). It is also available as thin as 0.000100" (0.00254 mm) and in widths up to 4" (101.6 mm) maximum.

### GENERAL INFORMATION

The TCR can be adjusted from the furnished cold rolled values by using a low temperature heat treatment to achieve compensation for all types of spring elements. The foil is normally supplied with 90% cold reduction and a smooth bright surface. The foil is reasonably flat at 4" wide and nearly free of pinholes. The cold rolled foil can be produced with a TCR between +10 to -35 PPM/°C. The heat treatment will shift the foil TCR to the desired value. A typical heat-treat curve for Constantan® shows decreasing resistivity but increasing TCR with increased heat-treating temperature (Figure 1).



## Technical Data

TYPICAL MECHANICAL PROPERTIES <sup>1</sup>		
	ANNEALED	COLD ROLLED
Ultimate Tensile Strength	60,000 PSI	120,000 PSI
Elongation in 2" *	25%	2%
Modulus of Elasticity (Tension)	24 x 10 <sup>6</sup> PSI	

\* The measured elongation will be less as thickness decreases to 0.002" and less.

<sup>1</sup> These values may be adjusted by control of process variables – consult HPM for desired values.

NOMINAL COMPOSITION	
Nickel	44.2%
Manganese	1.5%
Iron	0.50
Copper	Balance

PHYSICAL PROPERTIES <sup>2</sup>	
Density	0.321 lbs/cu.in.
Melting Point (Approx.)	1210°C
Electrical Resistivity @ R.T.	50.8 Microhm · cm
Temperature Coefficient of Resistivity (TCR) (25° to 105°C)	± 30 PPM/°C
Thermal Expansion Coefficient (20°C to 100°C)	14.9 x 10 <sup>-6</sup> /°C
Thermal EMF vs. Copper (0°C to 100°C)	-0.043 Millivolts/°C
Thermal Conductivity R.T.	21.2W/m · K
Magnetic Attraction	None
Specific Heat	0.094 gram · cal./°C

<sup>2</sup> Typical values to guide alloy selection but are not a guarantee of minimum or maximum.

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