IMI SCOTT LTD
Resistance Wire and Elements
Thermocouple Wire and Cable

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IMI
a subsidiary of IMI plc.

Thermocouple Alloys for Type K Thermocouple and Extension Wires

Nicro + & Nial -

IMI Scott Nicro and Nial alloys are available in solid wire, strip or tape and flexible bunch or strand constructions. Material can be ordered to all National or International emf standards as well as customer's own specifications.

Physical and Mechanical Properties (Values stated are nominal or typical.)

		Units	Nicro +	Nial -
Nominal composition		%	Ni 90 Cr 10	Ni 95 Al,Mn,Si+
Density at 20°C		g/cm³ lb/in³	8.72 0.315	8.60 0.310
Resistivity at 20°C		µΩcm Ω/cmf	70 420	29 174
Coefficient of thermal expansion	20 – 100°C 68 – 212°F	1/K 1/°F	17×10^{-6} 9.4×10^{-6}	17×10^{-6} 9.4×10^{-6}
Thermal conductivity at	20°C 68°F	W/mK Btu.in/ft².h.°F	19.2 135	29.7 210
Melting point (approx.)		°C °F	1430 2610	1400 2552
Magnetic properties			Non-Magnetic	Magnetic
Tensile strength R_m (0.5mm annealed wire)		N/mm² lb/in²	650 95000	590 85000

Type K thermocouple wire is recommended for use in oxidising or inert atmospheres. The larger the diameter the greater the longevity at elevated temperatures. Detrimental effects can occur in the following circumstances where the use of protective sheaths is recommended:

- 'Green rot' can develop on the Nicro+ due to the preferential oxidation of Chromium occurring in a reducing or mildly oxidising atmosphere where the partial pressure of oxygen is low. This causes Chromium Oxide (Cr_2O_3) to form instead of the protective Nickel-Chromium Oxide ($NiO\text{-}Cr_2O_3$). In severe circumstances the Chromium Oxide swells and cracks the surface of the wire, allowing internal oxidation to take place. The removal of Chromium from the alloy is accompanied by a significant emf drop, especially in the range 816 °C to 1038 °C, and the alloy becomes magnetic. The presence of carbonaceous gases will enhance the attack by the formation of

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Chromium Carbide along the grain boundaries and oxidation becomes a progressive intercrystalline attack. This effect can also be observed in moist reducing atmospheres where there are no carbonaceous gases.

- Sulphur can act in a similar manner to carbonaceous gases, with the formation of chromium sulphide before oxidation in the Nicro+ and intercrystalline corrosion and cracking in the Nial-.
- In a vacuum the Chromium element will evaporate from Nicro+ causing the emf to drop.