

The thermocouple element materials listed below are those most commonly found in process applications. Selection of the proper thermocouple type for a particular application is determined by temperature expectations and by the environment in which the sensor will be placed. The following temperature and application tables are intended to aid in this selection. The thermocouples are listed by ASTM letter designations per thermocouple type.

Letter Designated Thermocouples

TYPE		TEMPERATURE RANGE	APPLICATION INFORMATION
J E230	Iron (+) Copper - 45% Nickel (Constantan) (-)	(0 to 760) °C [32 to 1400] °F	Suitable for vacuum, reducing, or inert atmospheres, oxidizing atmosphere with reduced life. Iron oxidizes rapidly above 538 °C [1000 °F] so only heavy gauge wire is recommended for high temperature. Bare elements should not be exposed to sulphurous atmospheres above 538 °C [1000 °F].
K E230	Nickel - 10% Chromium (+) Nickel - 2% Aluminum, 2% Manganese, 1% Silicon (-)	(0 to 1260) °C [32 to 2300] °F	Recommended for continuous oxidizing or neutral atmospheres. Mostly used above 538 °C [1000 °F]. Subject to failure if exposed to sulphur. Preferential oxidation of chromium in positive leg at certain low oxygen concentrations causes 'green rot' and large negative calibration drifts most serious in the (816 to 1038) °C [1500 to 1900] °F range. Ventilation or inert-sealing of the protection tube can prevent this.
N E230	Nickel - 14% Chromium, 1 1/2% Silicon (+) Nickel - 4 1/2% Silicon - 1/10% Magnesium (-)	(0 to 1260) °C [32 to 2300] °F	Can be used in applications where Type K elements have shorter life and stability problems due to oxidation and the development of 'green rot'.
T E230	Copper (+) Copper - 45% Nickel (Constantan) (-)	(-200 to 370) °C [-328 to 700] °F	Useable in oxidizing, reducing, or inert atmospheres as well as vacuum. Not subject to corrosion in moist atmospheres. Limits of error published for sub-zero temperature ranges.
E E230	Nickel - 10% Chromium (+) Copper - 45% Nickel (Constantan) (-)	(0 to 870) °C [32 to 1600] °F	Recommended for continuously oxidizing or inert atmospheres. Sub-zero limits of error not established. Highest thermoelectric output of common calibrations.
R E230	Platinum - 13% Rhodium (+) Platinum (-)	(538 to 1482) °C [1000 to 2700] °F	Recommended for high temperature. Must be protected with non-metallic protection tube and ceramic insulators. Continued high temperature usage causes grain growth which can lead to mechanical failure. Negative calibration drift caused by Rhodium diffusion to pure leg as well as from Rhodium volatilization. Type R is used in industry; Type S in the laboratory.
S E230	Platinum - 10% Rhodium (+) Platinum (-)		
B E230	Platinum - 30% Rhodium (+) Platinum - 6% Rhodium (-)	(871 to 1704) °C [1600 to 3100] °F	Same as R & S but output is lower. Also less susceptible to grain growth and drift.
C E230	95% Tungsten - 5% Rhenium (+) 74% Tungsten - 26% Rhenium (-)	(0 to 2315) °C [32 to 4200] °F	Very high temperature applications in inert or vacuum. Preferred over Tungsten/Tungsten-26% Rhenium because it is less brittle at low temperatures.

Non-Letter Designated Thermocouples

TYPE		TEMPERATURE RANGE	APPLICATION INFORMATION
M E1751	Nickel - 18% Molybdenum (+) Nickel - 0.8% Cobalt (-)	(-50 to 1410) °C [-58 to 2570] °F	High temperature applications in inert or vacuum atmosphere. Useful in many hydrogen applications. Continuous cycling causes excessive grain growth.
P E1751	Platinel II® Platinel 5355 (+) Platinel 7674 (-)	(0 to 1395) °C [32 to 2543] °F	Noble metal combination which approximates Type K curve but has much improved oxidation resistance. Should be treated as any noble metal calibration.

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