

Thermocouples Types · Conductor Combinations · Characteristics · National and International Standards

Code	Conductor Combinations		National Standards for Output of Thermocouple Conductors Those Standards noted in this column all conform with each other and are based upon IEC60584-1 & ITS-90	Approximate Generated EMF Change per Degree Celsius Change with Reference Junction at 0°C			Approximate Working Temperature Range of Measuring Junction. <i>NB. Not related to wire diameters and conductor insulating materials</i>		Thermocouple Output Tolerances IEC 60584-1 <i>see note A below</i>				Notes
	+Leg	-Leg		100°C	500°C	1000°C	CONTINUOUS	°C	SHORT TERM	TYPE	Tolerance Class 1	Tolerance Class 2	
K	NICKEL - CHROMIUM Also known as: Chromel®, Thermokanthal KP®, NICr, T1*, Tophel®	NICKEL - ALUMINIUM (magnetic) Also known as: Ni-Al, Alumel®, Thermokanthal KN®, T2*, NIAI®	BS EN 60584-1 (replaced BS 4937 Pt 4) ANSI/MC96.1 DIN EN 60584-1:1996 NF EN 60 584.1:1996 JISC 1602	42	43	39	0 to +1100	-180 to +1350	Temperature Range Tolerance Value Temperature Range Tolerance Value	-40°C to +375°C ±1.5°C 375°C to 1000°C ±0.004 r	-40°C to +333°C ±2.5°C 333°C to 1200°C ±0.0075 r	-167°C to +40°C ±2.5°C -200°C to -167°C ±0.015 r	Most suited to oxidising atmospheres, it has a wide temperature range and is the most commonly used.
T	COPPER	COPPER - NICKEL Also known as: Constantan, Advance®, Cupron®	BS EN 60584-1 (replaced BS 4937 Pt 5) ANSI/MC96.1 DIN EN 60584-1:1996 NF EN 60 584.1:1996 JISC 1602	46	-	-	-185 to +300	-250 to +400	Temperature Range Tolerance Value Temperature Range Tolerance Value	-40°C to +125°C ±0.5°C 125°C to 350°C ±0.004 r	-40°C to +133°C ±1.0°C 133°C to 350°C ±0.0075 r	-67°C to +40°C ±1.0°C -200°C to -67°C ±0.015 r	Excellent for low temperature and cryogenic applications. Good for when moisture may be present.
J	IRON (MAGNETIC) Also known as: Fe	COPPER - NICKEL Also known as: Nickel-Copper, Constantan, Advance®, Cupron®	BS EN 60584-1 (replaced BS 4937 Pt 3) ANSI/MC96.1 DIN EN 60584-1:1996 NF EN 60 584.1:1996 JISC 1602	54	56	59	+20 to +700	-180 to +750	Temperature Range Tolerance Value Temperature Range Tolerance Value	-40°C to +375°C ±1.5°C 375°C to 750°C ±0.004 r	-40°C to +333°C ±2.5°C 333°C to 750°C ±0.0075 r	-	Commonly used in the plastics moulding industry. Used in reducing atmospheres as an unprotected thermocouple sensor. NB. Iron oxidises at low (rusts) and at high temperatures.
N	NICKEL - CHROMIUM - SILICON Also known as: Nicresil	NICKEL - SILICON - MAGNESIUM Also known as: Nisil	BS EN 60584-1 (replaced BS 4937 Pt 8) ANSI/MC96.1 DIN EN 60584-1:1996 NF EN 60 584.1:1996 JISC 1602	30	38	39	0 to +1150	-270 to +1300	Temperature Range Tolerance Value Temperature Range Tolerance Value	-40°C to +375°C ±1.5°C 375°C to 1000°C ±0.004 r	-40°C to +333°C ±2.5°C 333°C to 1200°C ±0.0075 r	-167°C to +40°C ±2.5°C -200°C to -167°C ±0.015 r	Very stable output at high temperatures it can be used up to 1300°C. Good oxidation resistance. Type N stands up to temperature cycling extremely well.
E	NICKEL - CHROMIUM Also known as: Chromel®, Tophel®, Chromium, Nickel	COPPER - NICKEL Also known as: Nickel-Copper, Constantan, Advance®, Cupron®	BS EN 60584-1 (replaced BS 4937 Pt 6) ANSI/MC96.1 DIN EN 60584-1:1996 NF EN 60 584.1:1996 JISC 1602	68	81	-	0 to +800	-40 to +900	Temperature Range Tolerance Value Temperature Range Tolerance Value	-40°C to +375°C ±1.5°C 375°C to 800°C ±0.004 r	-40°C to +333°C ±2.5°C 333°C to 900°C ±0.0075 r	-167°C to +40°C ±2.5°C -200°C to -167°C ±0.015 r	Has the highest thermal EMF output change per °C. Suitable for use in a vacuum or mildly oxidising atmosphere as an unprotected thermocouple sensor.
R	PLATINUM - 13% RHODIUM	PLATINUM	BS EN 60584-1 (replaced BS 4937 Pt 2) ANSI/MC96.1 DIN EN 60584-1:1996 NF EN 60 584.1:1996 JISC 1602	8	10	13	0 to +1600	-50 to +1700	Temperature Range Tolerance Value Temperature Range Tolerance Value	0°C to +1100°C ±1.0°C 1100°C to 1600°C ±1 +0.003 (t 1100)°C	0°C to +600°C ±1.5°C 600°C to 1600°C ±0.0025 r	-	Used for very high temperature applications. Used in the UK in preference to Type S for historical reasons. Has a high resistance to oxidation and corrosion. Easily contaminated, it normally requires protection.
S	PLATINUM - 10% RHODIUM	PLATINUM	BS EN 60584-1 (replaced BS 4937 Pt 1) ANSI/MC96.1 DIN EN 60584-1:1996 NF EN 60 584.1:1996 JISC 1602	8	9	11	0 to +1550	-50 to +1750	Temperature Range Tolerance Value Temperature Range Tolerance Value	0°C to +1100°C ±1.0°C 1100°C to 1600°C ±1 +0.003 (t 1100)°C	0°C to +600°C ±1.5°C 600°C to 1600°C ±0.0025 r	-	Type S has similar characteristics to Type R as shown directly above.
B	PLATINUM - 30% RHODIUM	PLATINUM - 6% RHODIUM	BS EN 60584-1 (replaced BS 4937 Pt 7) ANSI/MC96.1 DIN EN 60584-1:1996 NF EN 60 584.1:1996 JISC 1602	1	5	9	+100 to +1600	+100 to +1820	Temperature Range Tolerance Value Temperature Range Tolerance Value	-	-	600°C to +800°C ±4.0°C 800°C to 1700°C ±0.0025 r	Type B has similar characteristics to Types R and S but is not so popular. Generally used in the glass industry.
C (Formerly Code W5)	TUNGSTEN 5% RHENIUM	TUNGSTEN 26% RHENIUM	BS EN 60584-1 DIN EN 60584-1 NF EN 60584-1 JIS C 1602 ASTM E 230	15	18	18	+50 to +1820	+20 to +2300	Temperature Range Tolerance Value Temperature Range Tolerance Value	-	-	426°C to 2315°C ±1.0%	Formerly known as Code W5. Tungsten Rhenium alloy combinations offer reasonably high and relatively linear EMF outputs for high temperature measurement up to 2600°C and good chemical stability at high temperatures in hydrogen, inert gas and vacuum atmospheres. Not practicable for use below 400°C. Not recommended for use in oxidising conditions.
G* (Formerly Code W)	TUNGSTEN	TUNGSTEN 26% RHENIUM	There are no officially recognised standards for Type G	5	16	21	+20 to +2320	0 to +2600	Temperature Range Tolerance Value Temperature Range Tolerance Value	-	0°C to +425°C ±4.5°C 425°C to 2320°C ±0.01 r	-	Formerly known as Code W. See technical notes for Type C directly above.
D* (Formerly Code W3)	TUNGSTEN 3% RHENIUM	TUNGSTEN 25% RHENIUM	There are no officially recognised standards for Type D	13	20	20	0 to +2100	0 to +2600	Temperature Range Tolerance Value Temperature Range Tolerance Value	-	0°C to +400°C ±4.5°C 400°C to 2320°C ±1.0%	-	Formerly known as Code W3. See technical notes for Type C above.

* Codes G and D and the tolerance values shown above are not officially recognised symbols or standards.
 * Trade names.

Note A
 1. The tolerance is expressed either as a deviation in degrees Celsius or as a function of the actual temperature.
 2. Thermocouple materials are normally supplied to meet the tolerances specified in the table for temperatures above -40 deg C. These materials however, may not fall within the tolerances for low temperatures given under Class 3 for Types T, E and K thermocouples. If thermocouples are required to meet limits of Class 3, as well as those of Class 1 and/or Class 2, the purchaser should state this, as selection of materials is usually required.