



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 IEC60584.1:1995 & ITS-90	Approximate Generated EMF Change per Degree Celsius Change with Reference Junction at 0°C µV/°C at			Approximate Working Temperature Range of Measuring Junction. <i>NB. Not related to wire diameters and conductor insulating materials</i>		Thermocouple Output Tolerances IEC 60584.2:1993, (BS EN 60584.2:1993) Note BS EN 60584.2:1993 replaced BS 4937 Pt 20:1991 <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	Tolerance Class 3	
K	NICKEL - CHROMIUM <small>Also known as: Chromel*, Thermokanthal KP*, NiCr, Ti*, Tophel*</small>	NICKEL - ALUMINIUM (MAGNETIC) <small>Also known as: Ni-Al, Alumel*, Thermokanthal KN*, T2*, NIAI*</small>	BS EN 60584.1 Pt4:1996 (Replaces 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 · t	–40°C to +333°C ±2.5°C 333°C to 1200°C ±0.0075 · t	–167°C to +40°C ±2.5°C –200°C to –167°C ±0.015 · t	Most suited to oxidising atmospheres, it has a wide temperature range and is the most commonly used.
T	COPPER	COPPER - NICKEL <small>Also known as: Constantan, Advance*, Cupron*</small>	BS EN 60584.1 Pt5:1996 (Replaces 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 · t	–40°C to +133°C ±1.0°C 133°C to 350°C ±0.0075 · t	–67°C to +40°C ±1.0°C –200°C to –67°C ±0.015 · t	Excellent for low temperature and cryogenic applications. Good for when moisture may be present.
J	IRON (MAGNETIC) <small>Also known as: Fe</small>	COPPER - NICKEL <small>Also known as: Nickel-Copper, Constantan, Advance*, Cupron*</small>	BS EN 60584.1 Pt3:1996 (Replaces 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 · t	–40°C to +333°C ±2.5°C 333°C to 750°C ±0.0075 · t	– – – –	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 <small>Also known as: Nicrosil</small>	NICKEL - SILICON - MAGNESIUM <small>Also known as: Nisil</small>	BS EN 60584.1 Pt8:1996 (Replaces 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 +1100	–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 · t	–40°C to +333°C ±2.5°C 333°C to 1200°C ±0.0075 · t	–167°C to +40°C ±2.5°C –200°C to –167°C ±0.015 · t	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 <small>Also known as: Chromel*, Tophel*, Chromium, Nickel</small>	COPPER - NICKEL <small>Also known as: Nickel-Copper, Constantan, Advance*, Cupron*</small>	BS EN 60584.1 Pt6:1996 (Replaces 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 · t	–40°C to +333°C ±2.5°C 333°C to 900°C ±0.0075 · t	–167°C to +40°C ±2.5°C –200°C to –167°C ±0.015 · t	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 Pt2:1996 (Replaces 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 · t	– – – –	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 Pt1:1996 (Replaces 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 · t	– – – –	Type S has similar characteristics to Type R as shown directly above.
B	PLATINUM - 30% RHODIUM	PLATINUM - 6% RHODIUM	BS EN 60584.1 Pt7:1996 (Replaces 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 1700°C ± 0.0025 · t	600°C to +800°C ±4.0°C 800°C to 1700°C ±0.005 · t	Type B has similar characteristics to Types R and S but is not so popular. Generally used in the glass industry.
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 ±1.0%	– – – –	Formerly known as Code W. 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. They are not practicable for use below 400°C. Not recommended for use in oxidising conditions.
C* (Formerly Code W5)	TUNGSTEN 5% RHENIUM	TUNGSTEN 26% RHENIUM	There are no officially recognised standards for Type C	15	18	18	+50 to +1820	+20 to +2300	Temperature Range Tolerance Value Temperature Range Tolerance Value	– – – –	0°C to +426°C* ±4.4°C 426°C to 2320°C ±1.0%	– – – –	Formerly known as Code W5. See technical notes for Type G 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 G directly above.

* Codes G, C 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.