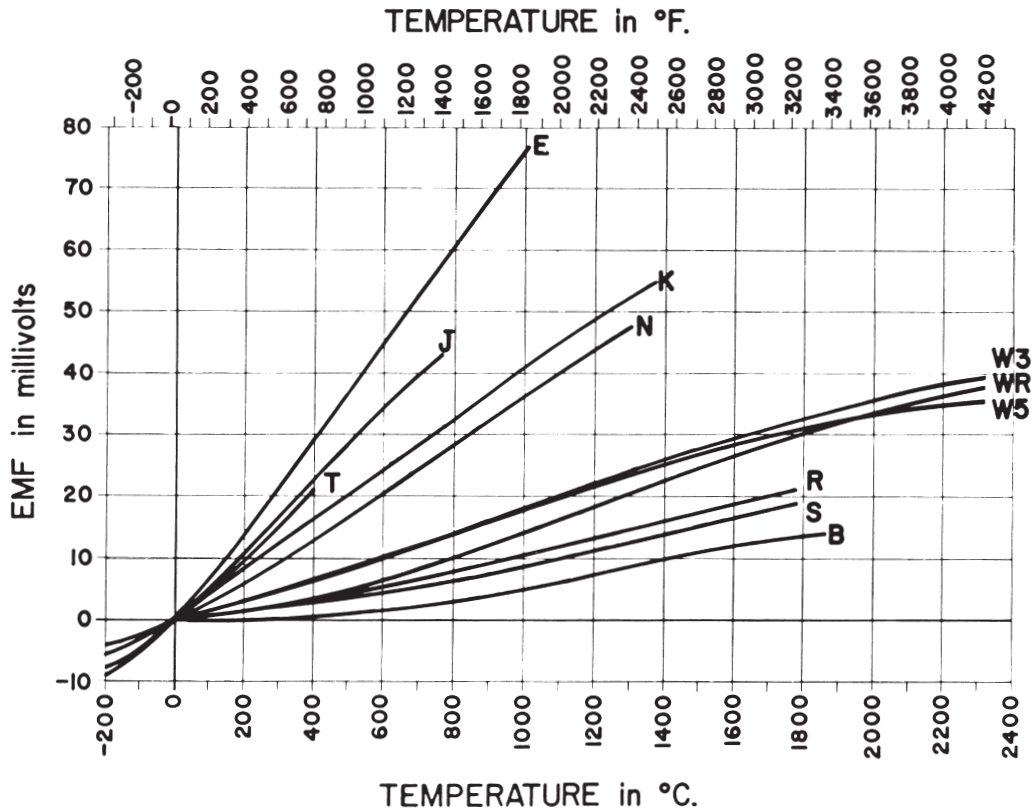


The primary factor in selecting a thermocouple for a given application is the temperature range it will be exposed to, the graph below offers a quick reference for this purpose. Other important factors to consider are the expected lifespan of the element and the process conditions present during operation. Listed below, in order of increasing maximum temperature limits, are the most commonly used thermocouple calibrations.



ISA Calibration, Element Composition, Recommended Temperature Range, Application Information:

Type T, Copper (+) Constantan (-), -184 to 371°C, Suitable in oxidizing, reducing, or inert atmospheres as well as vacuum. Moisture resistant and very stable. This type is best suited for low temperature service.

Type J, Iron (+) Constantan (-), 0 to 760°C, Suitable for vacuum, reducing, or inert atmospheres, oxidizing atmospheres with reduced life. As Iron oxidizes rapidly above 538°C, use only heavy gauge wire for high temperatures. Avoid exposing bare wires to sulphurous environments.

Type E, Chromel (+) Constantan (-), 0 to 871°C, Recommended for continuous oxidizing or inert atmospheres. Produces the highest EMF (mV) per degree of all common calibrations.

Type K, Chromel (+) Alumel (-), 0 to 1260°C, Recommended for continuous oxidizing or inert atmospheres. Most common for temperatures above 538°C. Not suitable for sulfur environments. Low oxygen levels can produce "green rot", particularly in the 816 - 1038°C range. Use of purge system, inert seal or Type N is recommended for this condition.

Type N, Nicrosil (+) Nisil (-), 0 to 1260°C, Suitable replacement for Type K where oxidization and "green rot" are a concern.

Type R, Platinum 13% Rhodium (+) Platinum (-), 538 to 1482°C, Recommended for high temperature applications. Must be protected with non-metallic protection tube. Continued high temperature use can lead to mechanical failure. Most common in industrial applications.

Type S, Platinum 10% Rhodium (+) Platinum (-), 538 to 1482°C, Same as Type R with most common applications in laboratories.

Type B, Platinum 30% Rhodium (+) Platinum (-), 871 to 1705°C, Same as R & S with lower EMF but greater resistance to mechanical failure.

Non ANSI Coded Thermocouples:

Type WR, Tungsten (+) Tungsten 26% Rhenium (-), 0 to 2315°C

Type W3, Tungsten 3% Rhenium (+) Tungsten 26% Rhenium (-), 0 to 2315°C

Type W5, Tungsten 5% Rhenium (+) Tungsten 26% Rhenium (-), 0 to 2315°C

Very high temperature applications in inert or vacuum environments. WR is the most brittle at lower temperatures and W5 the least, due to the Rhenium content in the positive leg.

TYPE	MATERIAL	TEMPERATURE RANGE for STANDARD LIMITS of ERROR	STANDARD LIMITS of ERROR	TEMPERATURE RANGE for SPECIAL LIMITS of ERROR	SPECIAL LIMITS of ERROR
T	Copper (+) Blue Constantan (-) Red	(-200 to -67°C) (-67 to 0°C) (0 to 133°C) (133 to 350°C)	± 1.5% (± 1 °C) (± 1 °C) ± 0.75%	(0 to 125°C) (125 to 350°C)	(± 0.5°C) ± 0.4%
J	Iron (+) White Constantan (-) Red	(0 to 293°C) (293 to 760°C)	(± 2.2°C) ± 0.75%	(0 to 275°C) (275 to 760°C)	(± 1.1°C) ± 0.4%
E	Chromel (+) Purple Constantan (-) Red	(-200 to -170°C) (-170 to 0°C) (0 to 340°C) (340 to 900°C)	± 1 % (± 1.7°C) (± 1.7°C) ± 0.5%	(0 to 250°C) (250 to 900°C)	(± 1°C) ± 0.4%
K	Chromel (+) Yellow Alumel (-) Red	(-200 to -110°C) (-110 to 0°C) (0 to 293°C) (293 to 1250°C)	± 2 % (± 2.2°C) (± 2.2°C) ± 0.75%	(0 to 275°C) (275 to 1250°C)	(± 1.1°C) ± 0.4%
N	Nicrosil (+) Orange Nisil (-) Red	(0 to 1260°C)	(± 2.2°C) ± 0.75%	(0 to 1250°C)	—————
R	Platinum 13% Rhodium (+) Black Platinum (-) Red	(0 to 600°C) (600 to 1450°C)	(± 1.5°C) ± 0.25%	(0 to 600°C) (600 to 1450°C)	(± 0.6°C) ± 0.1%
S	Platinum 10% Rhodium (+) Black Platinum (-) Red	(0 to 600°C) (600 to 1450°C)	(± 1.5°C) ± 0.25%	(0 to 600°C) (600 to 1450°C)	(± 0.6°C) ± 0.1%
B	Platinum 30% Rhodium (+) Black Platinum 6% Rhodium (-) Red	(800 to 1700°C)	±0.5%	(800 to 1700°C)	—————
WR	Tungsten (+) Tungsten 26% Rhenium (-)	(0 to 2315°C)	±1%	—————	—————
W3	Tungsten 3% Rhenium (+) Tungsten 26% Rhenium (-)	(0 to 2315°C)	±1%	—————	—————
W5	Tungsten 5% Rhenium (+) Tungsten 26% Rhenium (-)	(0 to 2315°C)	±1%	—————	—————

THERMOCOUPLE SIZE AND RESPONSE TIME (SECONDS)

BASED ON TIME TO INDICATE 63.2% OF VALUE FROM ROOM TEMPERATURE TO BOILING WATER

PROBE DIAMETER	CONDUCTOR SIZE NOMINAL (AWG)	RESPONSE TIME OF JUNCTION	
		GROUNDED	UNGROUNDED
.040	33	0.1	0.3
.0625	29	0.2	0.5
.0625 DUAL	31	0.2	0.5
.125	23	0.6	1.5
.125 DUAL	25	0.6	1.5
.187	19	1.1	2.2
.187 DUAL	21	1.1	2.2
.25	17	2.0	4.5
.25 DUAL	19	2.0	4.5
.375	14	2.9	8.2
.375 DUAL	15	3.9	8.2

RECOMMENDED TEMPERATURE LIMITS FOR METAL SHEATH THERMOCOUPLES

	T	J	E	K
1/25"	150°C	480°C	425°C	760°C
1/16"	205°C	540°C	550°C	980°C
1/8"	205°C	540°C	550°C	1000°C
3/16"	371°C	650°C	550°C	1000°C
1/4"	371°C	650°C	593°C	1100°C
3/8"	371°C	650°C	650°C	1200°C