ANSI Limits of Error

Unless otherwise specified, all thermocouple wire and extension wire is supplied to meet either Standard or Special Limits of Error per ASTM/ ANSI E - 230.

The Standard and Special Limits of Error for thermocouple and extension wires are given in the accompanying tables.

Where Limits of Error are given in percent, the percentage applies to the temperature being measured.

Limits of Error for Thermocouples and Thermocouple Wire

Reference Junction 0 °C [32 °F]

T/C TYPE	TEMPERATURE RANGE	LIMITS OF ERROR	
		STANDARD	SPECIAL
T	(0 to 133) °C [32 to 270] °F (133 to 350) °C [270 to 662] °F	± 1 °C [2 °F] ± 0.75%	± 0.5 °C [1 °F] ± 0.4%
J	(0 to 293) °C [32 to 559] °F (293 to 750) °C [559 to 1382] °F	± 2.2 °C [4 °F] ± 0.75%	± 1.1 °C [2 °F] ± 0.4%
E	(0 to 340) °C [32 to 644] °F (340 to 900) °C [644 to 1652] °F	± 1.7 °C [3 °F] ± 0.5%	± 1 °C [2 °F] ± 0.4%
K	(0 to 293) °C [32 to 559] °F (293 to 1250) °C [559 to 2282] °F	± 2.2 °C [4 °F] ± 0.75%	± 1.1 °C [2 °F] ± 0.4%
N	(0 to 293) °C [32 to 559] °F (0 to 1250) °C [559 to 2282] °F	± 2.2 °C [4 °F] ± 0.75%	± 1.1 °C [2 °F] ± 0.4%
R, S	(0 to 600) °C [32 to 1112] °F (600 to 1450) °C [1112 to 2642] °F	± 1.5 °C [3 °F] ± 0.25%	± 0.6 °C [1 °F] ± 0.1%
B	(870 to 1700) °C [1598 to 3092] °F	± 0.5%	
T[1]	(-200 to -66) °C [-328 to -87] °F (-66 to 0) °C [-87 to + 32] °F	± 1 °C [2 °F] ± 1.5%	
E[1]	(-200 to -100) °C [-328 to -148] °F (-100 to 0) °C [- 148 to 32] °F	± 1.1 °C [3 °F] ± 1%	
K[1]	(-200 to -110) °C [-328 to -166] °F (-110 to 0) °C [-166 to 32] °F	± 2.2 °C [4 °F] ± 2%	

[1] Thermocouples and thermocouple materials are normally supplied to meet the limits of error specified in the table for temperatures above 0 °C [32 °F]. The same materials, however, may not fall within the sub-zero limits of error given in the second section of the table. If materials are required to meet the sub-zero limits, the purchase order must so state. Selection of materials usually will be required. Little information is available to justify establishing special limits of error for sub-zero temperatures. Limited experience suggest the following limits for types E and T thermocouples:

Type E	(-200 to 0) °C [-328 to 32] °F
Type T	(-200 to 0) °C [-328 to 32] °F

These limits are given only as a guide for information purposes. Due to the characteristics of the materials, sub-zero limits of error for type J thermocouples and special sub-zero limits for type K thermocouples are not listed.

Limits of Error for Thermocouple

Extension Wire Reference Junction 0 °C [32 °F]

EXT. WIRE TYPE	TEMPERATURE RANGE	LIMITS OF ERROR	
		STANDARD	SPECIAL
KX	(0 to 200) °C [32 to 392] °F	± 2.2 °C [4 °F]	
JX	(0 to 200) °C [32 to 392] °F	± 2.2 °C [4 °F]	± 1.1 °C [2 °F]
EX	(0 to 200) °C [32 to 392] °F	± 1.7 °C [3 °F]	
TX	(0 to 100) °C [32 to 212] °F	± 1.0 °C [2 °F]	± 0.5 °C [1 °F]
NX	(0 to 200) °C [32 to 392] °F	± 2.2 °C [4 °F]	

Limits of Error for Thermocouple Compensating

Extension Wire Reference Junction 0 °C [32 °F]

T/C TYPE	COMPENSATION WIRE TYPE	TEMPERATURE RANGE	LIMITS OF ERROR[1]
R, S	SX§	(0 to 200) °C [32 to 392] °F	± 5 °C [9 °F]
B	BX#	(0 to 100) °C [32 to 212] °F	0 °C [0 °F] -3.7 °C [- 6 °F]

[1] Due to the non-linearity of the types R, S, and B temperature-EMF curves, the error introduced into a thermocouple system by the compensating wire will be variable when expressed in degrees. The degree C tolerances given in parentheses are based on the following measuring junction temperatures:

WIRE TYPE	MEASURING JUNCTION TEMPERATURE
SX	Greater than 870 °C [1598] °F
BX	Greater than 1000 °C [1832] °F

§ Copper (+) versus copper nickel alloy (-)

Copper versus copper compensating extension wire, usable to 100 °C [212 °F] with maximum errors as indicated, but with no significant error over (0 to 50) °C [32 to 122] °F range. Matched proprietary alloy compensating wire is available for use over the range (0 to 200) °C [32 to 392] °F with claimed tolerances of (+ 0.033 mV + 3.7) °C[1].

Calibrating, Checking, and Tagging

Pyromation thermocouple wire and extension wire is available calibrated, "checked and tagged" when so specified, at an extra charge. Wires of this classification are within the Standard Limits of Error but, most important, their specific departure at temperatures specified is known and can be taken into account. Each thermocouple, coil, reel, or spool of wire is checked and tagged to show the departure from the curve. Single conductors will be calibrated to show their EMF values versus pure platinum, with a 0 °C [32 °F] reference junction unless otherwise specified. Thermocouples and wire sample sent to the factory for evaluation must be at least 36" long.

The temperature range for all checking and selecting is from 0 °C [32 °F] to 1371 °C [2500 °F], depending on type and gauge of wire. Sub-zero checking to -79 °C [-110 °F] and high temperature rising from 1371 °F [2500 °F] to 1649 °C [3000 °F] is available. Calibration can also be accomplished at standard check points such as boiling points of helium, oxygen, and nitrogen.