

Extension Thermocouple Wire

Types of Thermocouple Wire

Thermocouple wires are classified into different types based on alloy composition of each wire in the pair. Code letters for wire types are designated by the American National Standards Institute (ANSI). Table 1 provides an overview of the different types of wires.

ANSI Code	+ Lead	- Lead	Temperature Range	Notes
J	Iron (Fe)	Copper-Nickel Cu-(Ni)	-210 to 1200°C -346 to 2193°F	Limited range; use with 'nonmodern' equipment; magnetic
K	Nickel- Chromium (Ni-Cr)	Nickel-Aluminum (Ni-Al)	-270 to 1372°C -454 to 2501°F	General purpose
T	Copper (Cu)	Copper-Nickel (Cu-Ni)	-270 to 400°C -454 to 752°F	Low temperature / cryogenic use; good when moisture present
E	Nickel-Chromium (Ni-Cr)	Copper-Nickel (Cu-Ni)	-270 to 1000°C -454 to 1832°F	Low temperature / cryogenic use
N	Nicrosil (Ni-Cr-Si)	Nisil (Ni-Si-Mg)	-270 to 1300°C -454 to 2372°F	High stability; high temperature use; low cost
R	Platinum-13% Rhodium (Pt-13% Rh)	Platinum (Pt)	-50 to 1768°C -58 to 3214°F	High temperature use; low sensitivity; high cost
S	Platinum-10% Rhodium (Pt-10% Rh)	Platinum (Pt)	-50 to 1768°C -58 to 3214°F	High temperature use; low sensitivity; high cost
U	Copper (Cu)	Copper-Low Nickel (Cu-Ni)		Connecting wire for R & S thermocouples
B	Platinum-30% Rhodium (Pt-30% Rh)	Platinum-6% Rhodium (Pt-6% Rh)	0 to 1820°C to 3308°F	High temperature use; unusable below 50°C
W	Tungsten (W)	Tungsten-26% Rhenium (W-26% Re)	0 to 2320°C to 4208°F	High temperature; not practical below 399°C
W ₅	Tungsten-5% Rhenium (W-5% Re)	Tungsten-26% Rhenium (W-26% Re)	0 to 2320°C to 4208°F	High temperature; not practical below 399°C
W ₃	Tungsten-3% Rhenium (W-3% Re)	Tungsten-25% Rhenium (W-25% Re)	0 to 2320°C to 4208°F	High temperature; not practical below 399°C

Insulation Type

Insulation selection is important for protecting thermocouple wires from various types of corrosion. Tables 2 and 3 describe different types of insulation and the properties and resistances they exhibit.

Insulation Code	Insulation		Temperature Range	Abrasion Resistance	Flexibility	Water Submersion
	Overall	Conductors				
PP	Polyvinyl Chloride (PVC)	Polyvinyl Chloride (PVC)	-40 to 105°C -40 to 221°F	Good	Excellent	Good
FF	FEP Teflon® or Neoflon	FEP Teflon® or Neoflon	-200 to 200°C -338 to 392°F	Excellent	Good	Excellent
TT	PFA Teflon® or Neoflon	PFA Teflon® or Neoflon	-267 to 260°C -450 to 500°F	Excellent	Good	Excellent
KK	Kapton	Kapton	-267 to 316°C -450 to 600°F	Excellent	Good	Good
TG	Glass Braid	PFA Teflon® of Neoflon	-73 to 260°C -100 to 500°F	Good	Good	Excellent
GG	Glass Braid	Glass Braid	-73 to 482°C -100 to 900°F	Poor	Good	Poor
HH	High Temp Glass Braid	High Temp Glass Braid	-73 to 871°C -100 to 1300°F	Poor	Good	Poor
XR	Refrasil Braid	Refrasil Braid	-73 to 871°C -100 to 1600°F	Poor	Good to 315°C (600°F)	Poor to 315°C (600°F)
XC	Nextel Braid	Nextel Braid	-73 to 1204°C -100 to 2200°F	Poor	Good	Poor
XS	Silica	Silica	-73 to 1038°C -100 to 1990°F	Poor	Good	Poor
TFE	TFE Teflon®	TFE Teflon®	-267 to 260°C -450 to 500°F	Excellent	Good	Excellent

Insulation Code	Resistance To:					Comments
	Solvent	Acid	Base	Flame	Humidity	
PP	Fair	Good	Good	Good	Good	Affected by ketones, esters
FF	Excellent	Excellent	Excellent	Excellent	Excellent	Affected by ketones, esters
TT	Excellent	Excellent	Excellent	Excellent	Excellent	Superior abrasion & moisture resistance. Same basic characteristics as FEP but high temperature rating
KK	Good	Good	Good	Good	Excellent	Excellent moisture & abrasion resistance, high dielectric strength, resistance to gamma radiation, used as adhesive binding agent
TG	Excellent	Excellent	Excellent	Excellent	Excellent	Used for single measurement up to 343°C (650°F)
GG	Excellent	Excellent	Excellent	Excellent	Fair	Binder improves moisture and abrasion resistance, but is destroyed above 204°C (400°F)
HH	Excellent	Excellent	Excellent	Excellent	Fair	Binder improves moisture and abrasion resistance, but is destroyed above 204°C (400°F)
XR	Excellent	Good to 315°C (600°F)	Good to 315°C (600°F)	Excellent	Poor	Suitable to 982°C (1800°F) if not subjected to flexure or abrasion
XC	Excellent	Good	Good	Excellent	Fair	Not recommended for platinum thermocouples or exposure to molten tin and copper, hydrofluoric or phosphoric acids, or strong alkalies
XS	Excellent	Good	Poor	Excellent	Fair	High purity, chemically stable. (SiO ₂ content 99%)
TFE	Excellent	Excellent	Excellent	Excellent	Excellent	Superior abrasion, moisture, and chemical resistance

Physical Size

Thermocouple wires may be sized differently depending on the application. Dimensions include diameter, gauge thickness, and length.

Diameter of the wire can have an impact on the response time of the thermocouple element.

Gauge thickness refers to the numerical gauge or AWG thickness of the wire product.

Length is the distance the wire extends.