



## Thermocouple Application Data

Calibration Code	Conductor & Characteristics		Recommended Temp. Range	Limits of Error			Application Information
	Positive	Negative		Range °F	Standard	Special	
J	Iron (Magnetic)	Constantan® (Non-Magnetic)	32 to 1400°F (0 to 760°C)	32 to 1400°F (0 to 760°C)	±4.0°F (±2.2°C) or ±0.75%*	±2.0°F (±1.1°C) or ±0.4%*	Suitable for vacuum, reducing, or inert atmospheres. Reduced life in oxidizing atmosphere. Iron oxidizes rapidly above 1000°F so only heavy gauge wire is recommended for high temperature. Bare elements should not be exposed to sulphurous atmospheres above 1000°F.
Jx	White	Red	—	32 to 392°F (0 to 200°C)	±4.0°F (±2.2°C)	±2.0°F (±1.1°C)	Compensating extension wire for "J" calibration.
K	Chromel® (Non-Magnetic)	Alumel® (Magnetic)	32 to 2300°F (0 to 1260°C)	-328 to 32°F (-200 to 0°C) 32 to 2300°F (0 to 1260°C)	±3.96°F (±2.2°C) or ±2.0%* ±4.0°F (±2.2°C) or ±0.75%	±2.0°F (±1.1°C) or ±0.4%	Recommended for continuous oxidizing or neutral atmospheres. Mostly used above 1000°F. Subject to failure if exposed to sulphur. Preferential oxidation of chromium in positive leg at certain low oxygen concentrations causes "green rot" and large negative calibration drifts most serious in the 1500-1900°F temperature range.
Kx	Yellow	Red	—	32 to 392°F (0 to 200°C)	±4.0°F (±2.2°C)	±2.0°F (±1.1°C)	Compensating extension wire for "K" calibration.
T	Copper (Yellow Metal)	Constantan® (Silver Metal)	-328 to 700°F (-200 to 371°C)	-328 to 32°F (-200 to 0°C) 32 to 700°F (0 to 371°C)	±1.8°F (±1.0°C) or ±1.5%* ±1.8°F (±1.0°C) or ±0.75%*	±0.9°F (±0.5°C) or ±0.4%*	Usable in oxidizing, reducing, or inert atmospheres, as well as vacuum. Not subject to corrosion in moist atmospheres.
Tx	Blue	Red	—	-75 to 212°F (-60 to 100°C)	±1.8°F (±1.0°C)	±0.9°F (±0.5°C)	Compensating extension wire for "T" calibration.
E	Chromel®	Constantan®	32 to 1600°F (0 to 871°C)	-328 to 32°F (-200 to 0°C) 32 to 1600°F (0 to 871°C)	±3.06°F (±1.7°C) or ±1.0%* ±3.06°F (±1.7°C) or ±0.5%*	±1.8°F (±1.0°C) or ±0.4%*	Recommended for continuous oxidizing or inert atmospheres. Highest thermoelectric output of common calibrations.
Ex	Purple	Red	—	32 to 392°F (0 to 200°C)	±3.06°F (±1.7°C)	±1.8°F (±1.0°C)	Compensating extension wire for "E" calibration.
R	Platinum 13% Rhodium	Platinum	32 to 2700°F (0 to 1482°C)	32 to 2700°F (0 to 1482°C)	±2.7°F (±1.5°C) or ±0.25%*	±1.08°F (±0.6°C) or ±0.1%*	Recommended for high temperature. Requires non-metallic protection tube and ceramic insulators. Long-term high temperature use causes grain growth and mechanical failure. Negative calibration drift caused by rhodium diffusion to pure leg as well as from rhodium volatilization.
S	Platinum 10% Rhodium	Platinum	32 to 2700°F (0 to 1482°C)	32 to 2700°F (0 to 1482°C)	±2.7°F (±1.5°C) or ±0.25%*	±1.08°F (±0.6°C) or ±0.1%*	Same as "R" calibration but output is lower. Also susceptible to grain growth and drift.
RSx	Copper (Black)	Alloy 11 (Red)	—	32 to 392°F (0 to 200°C)	±9°F (±5°C)	—	Compensating extension wire for "R" and "S" calibration.
B	Platinum 30% Rhodium	Platinum 6% Rhodium	1600 to 3100°F (870 to 1705°C)	1600 to 3100°F (870 to 1705°C)	±0.5%*	±0.25%*	Same as "R" calibration but output is lower. Also susceptible to grain growth and drift.
Bx	Gray	Red	—	32 to 392°F (0 to 200°C)	±7.6°F (±4.2°C)	—	Compensating extension wire for "B" calibration.
W5	Tungsten 5% Rhenium	Tungsten 26% Rhenium	32 to 4200°F (0 to 2315°C)	32 to 800°F (0 to 426°C) 800 to 4200°F (426 to 2316°C)	±8.0°F (±4.4°C) ±1%*	—	For very high temperature applications in inert and vacuum atmospheres.
L	Platinel II® +	Platinel II® -	32 to 2543°F (0 to 1395°C)	392 to 2192°F (200 to 1200°C)	±0.150mv to ±0.315mv	±0.100mv to ±0.158mv	Noble metal combination that approximates the "K" calibration but has much improved oxidation resistance. Should be treated as any noble metal thermocouple.
N	Nicrosil®	Nisil®	32 to 2300°F (0 to 1260°C)	32 to 2300°F (0 to 1260°C)	±4.0°F (±2.2°C) or ±0.75%*	±2.0°F (±1.1°C) or ±0.4%*	Modern nickel based alloy similar to "K" calibration but offering lower drift and longer life at high temperatures.
Nx	Orange	Red	—	32 to 392°F (0 to 200°C)	±4.0°F (±2.2°C)	±2.0°F (±1.1°C)	Compensating extension wire for "N" calibration.
Nickel-Moly	NiMo (Nickel-18% Molybdenum)	Nickel (Nickel-0.8% Cobalt)	32 to 2250°F (0 to 1232°C)	—	—	—	Used in hydrogen applications. Cycling causes excessive grain growth.

# Thermocouple Application Data

## Temperature Limits for Protected Thermocouples

The suggested temperature limits for continuous duty are shown for both our "Series 2" and "Series 3" thermocouples which utilize metallic and/or ceramic protection tubes and our "Series 6" Naba-Pak® thermocouples.

Calibration Code - Thermocouple Type	Thermocouple in Metallic or Ceramic Protection Tube					Metal Sheathed, Compacted MgO Insulated, Naba-Pak® Thermocouple			
	8 AWG	14 AWG	20 AWG	24 AWG	30 AWG	3/8" & 1/2" Sheath OD	1/4" & 5/16" Sheath OD	3/16" Sheath OD	0.02" to 1/8" OD
<b>J</b> Iron/Constantan®	1400°F (760°C)	1100°F (593°C)	900°F (482°C)	700°F (371°C)	700°F (371°C)	1100°F (593°C)	1000°F (538°C)	900°F (482°C)	700°F (371°C)
<b>K</b> Chromel®/Alumel®	2300°F (1260°C)	2000°F (1093°C)	1800°F (982°C)	1600°F (871°C)	1400°F (760°C)	2000°F (871°C)	2000°F (871°C)	2000°F (871°C)	1600°F (871°C)
<b>T</b> Copper/Constantan®	-	-	500°F (260°C)	400°F (204°C)	300°F (149°C)	700°F (371°C)	600°F (316°C)	500°F (260°C)	400°F (204°C)
<b>E</b> Chromel®/ Constantan®	1600°F (871°C)	1200°F (649°C)	1000°F (538°C)	800°F (427°C)	700°F (370°C)	1200°F (649°C)	1100°F (593°C)	1000°F (538°C)	800°F (427°C)
<b>R</b> Plat. 13% Rhodium/ Platinum	-	-	-	2700°F (1482°C)	-	-	-	-	-
<b>S</b> Plat. 10% Rhodium/ Platinum	-	-	-	2700°F (1482°C)	-	-	-	-	-
<b>B</b> Plat. 30% Rhodium/ Plat. 6% Rhodium	-	-	-	3100°F (1705°C)	-	-	-	-	-
<b>W5</b> Tung. 5% Rhenium/ Tung. 26% Rhenium	-	-	-	4200°F (2316°C)	-	-	-	-	-
<b>N</b> Nicrosil®/Nisil®	2300°F (1260°C)	2000°F (1093°C)	1800°F (982°C)	-	-	2000°F (871°C)	2000°F (871°C)	2000°F (871°C)	1600°F (871°C)
<b>Nickel-Moly</b> Nickel 18% Moly/ Nickel 0.8% Cobalt	-	2250°F (1232°C)	-	-	-	-	-	-	-