

# Technical Reference Manual

# About this Manual

In today's plant environment, the hundreds of different sensors and technologies used in the process simply doesn't allow any one individual to be an expert on all of them. Too often, especially with temperature, there is a temptation to replace the sensor with the identical technology. After all, that sensor has been working well for the last five years, why change it? Lets put this in the proper perspective. Here are just a few changes that have occurred over the last few years.

1. A regime change in Iraq.
2. A currency change in Eastern Europe – the Euro now replaces the franc, lira etc.
3. A change in the tax you pay on the gains when you sell your primary residence - it is now zero.

Reviewing these changes one can determine that depending on where you sit the change can be good, bad or of no consequence. Unless you traveled to eastern Europe the currency change probably did not affect you. But if you ignored the change in the tax law - you would have missed a rare and generous gift that your government bestowed on those that kept their eyes open to change. While this manual probably won't change your life what it will do is to make you more aware of some of the more recent and significant changes in temperature sensor technology and how those changes can improve your process.

There are three significant areas in this manual and they deserve a summary discussion:

## **Sensor Theory & Specification**

Nothing much has *changed* here! It is an excellent primer for gaining understanding on how thermocouples and resistance temperature detectors work.

## **Reference Tables**

Thermocouple and RTD reference tables complete with all the latest *changes*.

## **New Techniques that Improve Accuracy**

The *changes* in calibration that can help improve the accuracy of your temperature loops. This is important because *changes* that improve accuracy in the instruments that control, record or measure temperature are wasted if no *changes* are made to the primary device.

It would be difficult if not impossible to provide a manual that provided all the technical detail required for specifying and understanding Thermocouples and RTDs and how they apply to your process. We feel that this manual will give you a good start. We do encourage you to use it as a guide only and to call Smart Sensors for specific information and updates.

Finally, our success can be attributed to providing safe, accurate and reliable process temperature measurement solutions; while never forgetting our customer service obligations. Borrowing the words of speaker and author Tom Reilly:

***"Customer service is a function of our performance relative to your expectations."***

If we ever fail to live up to this motto, please do not hesitate to contact me.



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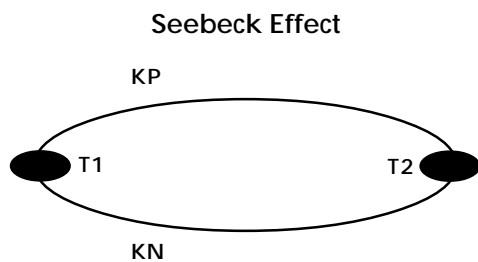
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# Temperature Sensor Theory

There are many different types of temperature sensors. We will deal with the two most common types, thermocouples and RTDs. Not because they are the most common, but because these two are the only two types Smart Sensors makes. (So if you are curious about other sensors, you will have to go elsewhere to find out how they work).

## Thermocouples - How do they work?

In 1821 Thomas Seebeck, while making a pot of tea, discovered that when two dissimilar metals are joined together, a current flows, as long as the temperature at one of the junctions is at a higher temperature than the other junction. Little did he know, as he finished his tea, that he would be famous for discovering the current that flowed in this circuit and the EMF (Electro Motive Force) that produced this current would be forever called the Seebeck Effect.

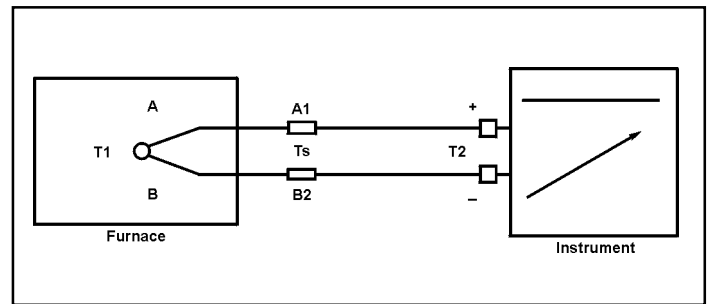


*Seebeck circuit showing the positive (kp) and negative (kn) of a Chromel Alumel thermocouple. If the temperatures (T1 and T2) are different at the two junctions a current will flow in the circuit.*

Seebeck was responsible for developing the most rugged and simplistic yet cost effective way of measuring temperature over a broad range. Copper Constantan, Chromel Alumel, Iron Constantan and Chromel Constantan, the standard thermocouple calibrations that are in use today, were derived from this research. They work the same way the scientist's theory said they would work. When you apply heat to T1 and T2 is at a different temperature the two dissimilar metals will produce a EMF. The EMF is different for different metals and unfortunately it is not linear, but it is accurate enough to handle most process applications. Accuracy improvements have been made primarily by closer control of the chemical composition; today thermocouples have accuracy as low as 1/2 degree Fahrenheit. There have been other calibrations introduced since then and many improvements to the way thermocouples are used; but the credit for developing thermocouples as we use them today goes to Thomas Seebeck.

A few years later, Jean Peltier made the second most important contribution to thermocouple theory. In essence he discovered that when heat flows across a thermoelectric junction, heat is either absorbed or liberated. The direction of the current flow dictates whether the heat is absorbed or liberated. If the current produced by the Seebeck Effect is at the hotter of the two junctions, heat is absorbed, while heat is liberated at the cooler or cold junction. He discovered this phenomena without drinking a single cup of tea.

These two guys really developed the rules for the proper use of thermocouples. First, and most important, is that the EMF developed by the joining (hot junction) of two dissimilar metals will report the temperature at that junction regardless of the temperature along the length of the wires. Second, and my personal favorite, is that the introduction of a third metal in the circuit can cause unwanted variances in the EMF unless the same temperature is maintained along the entire length where the third metal is introduced. This means that all you thermocouple users can not use cheap baling wire to make your connections to the instrument. Third, quite simply stated this rule allows the EMF signal to be brought back to a standard reference junction, usually 32°F, without maintaining intermediate reference junctions at a constant temperature.



The diagram above has three junctions. The hot or measuring junction T1 reports the furnace temperature. A and B are the primary positive and negative thermocouple elements. A secondary junction Ts is used to transition to thermocouple extension wire. This is done to reduce the cost of the thermocouple circuit. The cost of MI cable is several times more expensive than thermocouple extension wire. Certain applications require the flexibility that only thermocouple extension wire can bring. Finally T2 as the reference junction connects the thermocouple to the instrument. Seebeck and Peltier discovered that if T1 and T2 are at the same temperature there will be no current flow in the circuit.

## Basic and Advanced Thermocouples

When it comes right down to it there are only two basic types of thermocouple constructions. One is the kind our old friends Peltier and Seebeck used: Two dissimilar wires with a junction and insulated from one another. This is the most rudimentary construction and it can work given the simplicity of the application. Second and let's get modern here; the mineral insulated cable design that SSI uses.

This type uses a high purity magnesium oxide (MgO) to insulate the thermocouple wires from each other and the sheath. This insulation possesses high insulation resistance and upper temperature limits that far exceed the usable range of standard grade thermocouples. It is densely packed within a metallic sheath to insure concentric positioning of the conductors and improved mechanical strength, even when exposed to mechanical pressures such as bending, twisting or flattening.

# Thermocouple Specification Criteria

Now that you know how they work, it's time to get right down to specifying a thermocouple. There are a gazillion parameters you could consider, however, 99.9999% of the time if you keep the following in mind your thermocouple will keep its little millivolt heart pumping away forever or until the next maintenance shutdown *whichever* occurs first.

**Operating Environment:** What is the operating temperature that the thermocouple will be used in? (Select from the tables provided in this section.) What is in the process that will affect the life or performance of the thermocouple?

**Cost/Performance Ratio:** How accurate do I want to be? Do I need Special Limits? How will the dynamics of the process affect the accuracy? Can I afford the accuracy want?

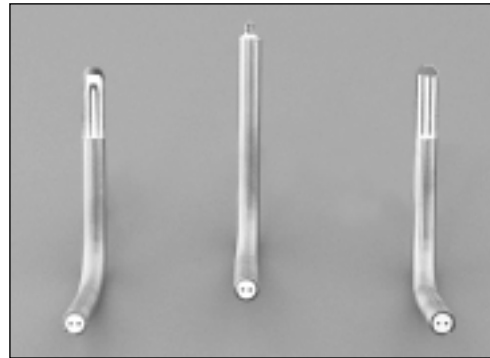
**Environment:** Do we protect the thermocouple by installing it in a well? What sheath material do we use on the thermocouple that will make it compatible with the environment?

**Calibration:** Since the ranges for calibrations tend to overlap there are other considerations in the selection criteria. The table below should help. See pages 17-68 for the most common thermocouple and RTD reference tables or visit our web site [www.smartsensors.com](http://www.smartsensors.com) for all reference tables.

**Response Time:** Typical response time for thermocouples range from a tenth of a second all the way up to 5 seconds, depending on the size of the thermocouple and the junction employed.

**Longevity:** Typically the larger the OD of the thermocouple the longer it will last. This criteria can be tricky. Take the cement contractor who wanted to measure the temperature of poured cement. The best thermocouple for him was a bare wire

thermocouple where the junction was twisted together. He could care less what the temperature was or if the thermocouple was working once the cement became concrete. We don't do business with a lot of cement contractors. The data below may



Shown is Smart Sensors' Mineral Oxide insulated thermocouple cable with a cut away of the three most common junctions, (from left) ungrounded, exposed, and grounded.

help you decide which size thermocouple is best. Response time is in seconds and measures a 63.2% step change in temperature from ambient to boiling water.

## Measuring Junction Typical Response Time

Sheath OD	Measuring Junction	Response Time*
.063 (1/16")	Grounded	.09
	Ungrounded	.28
.125 (1/8")	Grounded	.34
	Ungrounded	1.6
.188 (3/16")	Grounded	.7
	Ungrounded	2.6
.250 (1/4")	Grounded	1.7
	Ungrounded	4.5
	Exposed loop	.09

\*Sensors not in thermowell or protection tubes

## Calibration Selection Guide

Calibration Type	Conductors		Temperature Range °C	Limits of Error		Extension Wire Jacket Color	Color Coding
	Positive	Negative		Standard	Special		
J	Iron (Magnetic)	Constantan (Non-magnetic)	0°C to 750°C	±2.2°C or ±0.75%	±1.1°C or ±0.4%	Black	White+ Red-
K	Chromel (Non-magnetic)	Alumel (Magnetic)	-200°C to 0°C	±2.2°C or ±2%	-	Yellow	Yellow+ Red-
			0°C to 1250°C	±2.2°C or ±0.75%	±1.1°C or ±0.4%		
T	Copper (Non-Magnetic)	Constantan (Non-magnetic)	-200°C to 0°C	±1°C or ±1.5%	-	Blue	Blue+ Red-
			0°C to 350°C	±1°C or ±0.75%	±0.5°C or ±0.4%		
E	Chromel (Non-magnetic)	Constantan (Non-magnetic)	-200°C to 0°C	±1.7°C or ±1%	-	Purple	Purple+ Red-
			0°C to 900°C	±1.7°C or ±0.5%	±1°C or ±0.4%		
N	Nicrosil (Non-magnetic)	Nisil (Non-magnetic)	0°C to 1260°C	±3/4%	±3/8%	Orange	Orange+ Red-
R	Platinum 13% Rhodium (Non-magnetic)	Pure Platinum (Non-magnetic)	0°C to 1450°C	±1.5°C or ±0.25%	N/A	Green	Black+ Red-
S	Platinum 10% Rhodium (Non-magnetic)	Pure Platinum (Non-magnetic)	0°C to 1450°C	±1.5°C or ±0.25%	N/A	Green	Black+ Red-
B	Platinum 30% Rhodium (Non-magnetic)	Platinum 6% Rhodium (Non-magnetic)	870°C to 1700°C	±0.5%	N/A	Gray	Black+ Red-

### Calibration Notes

**J- Iron Constantan** - Reducing atmosphere recommended. Iron oxidizes rapidly at elevated temperatures. A larger gage size will extend the life of the iron wire.

**T- Copper Constantan** - Can be used in oxidizing or reducing atmospheres. Rust and corrosion resistant. Best for sub-zero temperatures.

**K- Chromel Alumel** - Oxidizing atmosphere recommended. Most commonly used base metal thermocouple. Cycling at high temperatures can cause calibration drift. Not recommended in sulfur environments.

**E- Chromel Constantan** - Oxidizing atmosphere recommended. Highest emf output of thermocouples commonly used. Good corrosion resistance

**S, R-** Use in oxidizing or inert atmospheres. Not recommended for reducing atmospheres. Granular precipitation from metal protection tubes can cause failure or calibration drift.

**N-** Use in oxidizing, reducing and inert atmospheres. Not recommended in sulfur environments. Improved resistance to drift and better stability over K and E at elevated temperatures.

## Thermocouple Construction Materials

The most basic thermocouple construction is the wire type consisting of two dissimilar metals homogeneously joined at one end to form the measuring junction. All wire-type thermocouples have an exposed junction. While wire-type thermocouples offer good response time, ruggedness, and high temperature use, they are susceptible to environmental conditions and therefore must be protected.

Mineral insulated thermocouples overcome the disadvantages of wire type construction by imbedding the thermocouple wires in ceramic insulation and protecting them with a metallic sheath. The mineral insulated cable (MI cable) design is based on small mass and high thermal conductivity which in turn promotes rapid heat transfer from the heat source to the measuring junction.

The sheaths are impervious to most liquids and gases and withstand high external pressures. The seamless design protects against moisture or other contaminants attacking the thermocouple elements. Since the only materials used to make the MI cable are the thermocouple conductors, the mineral oxide insulation and the metallic sheath, the cables are inherently fireproof thus providing the safest temperature measuring system.

### Mineral Insulated Cable

M.I. cable is designed to meet the following specifications:

**Sheath OD & Wall Thickness:** Per ASTM E-585

**Accuracy:** Per ASTM E-230 (1993) & ANSI MC96.1 (1988)

**Insulation Resistance @ Room Temperature:** Per ASTM E-585 (Table 2)

**Formability:** Per ASTM E-585 (Can be formed around a mandrel equal to twice the outside diameter without sheath rupture or loss of IR.)

**Fabrication:** The cable can be welded, brazed or soldered without changing IR. (Care should be taken with smaller diameter sheaths)

See MI Cable Specification Tables on page 9.

### Sheath Material

The table below shows just some of the many different materials which can be used to protect the mineral insulated thermocouple. Sheath materials used vary from standard stainless alloys like 304, 310, 316, 321, 347, 446 to the slightly more exotic alloy 600 or Hasteloy®.

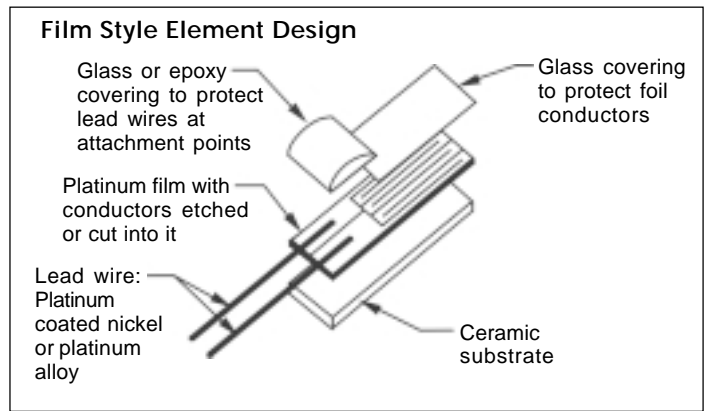
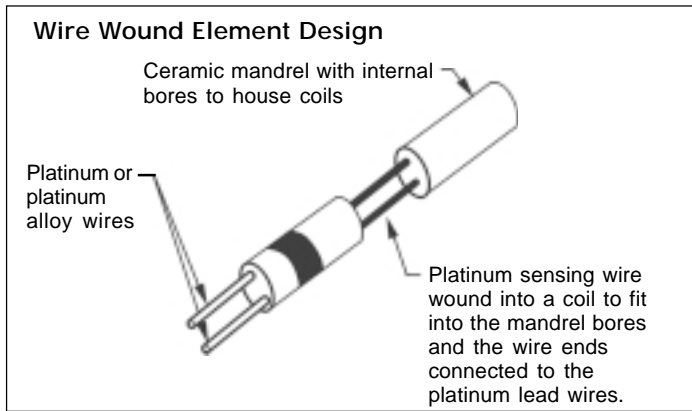
These sheaths are selected based on the rigors of the application with corrosion and temperature being the leading factors in sheath selection. The atmospheric environmental parameters are oxidizing, reducing, neutral, and vacuum. For example, 304 Stainless Steel can be used in each type of atmosphere with a maximum operating temperature of 1650°F.

## Sheath Material

Material	Melting Point °F	Max. Temp. in Air	Recommended	
			OPR ATM *	Continuous Max. Temp. °F
304SS	2560	1920	ORNV	1650
310 SS	2560	1960	ORNV	2100
316SS	2280	1760	ORNV	1650
321 SS	2580	1500	ORNV	1600
347SS	2600	1680	ORNV	1600
Inconel Alloy 600	2550	2000	ONV(c)	2100
Copper	1980	600	ORNV (b)	600
Aluminum	1220	800	ORNV	700
Platinum	3216	3000	ON(c)	3050
Molybdenum	4750	1000	VNR	4000
Tantalum	5440	750	V	4500
Titanium	3300	600	VN	2000

**Key:** O — Oxidizing  
 R — Reducing  
 N — Neutral  
 V — Vacuum  
 (b)— Scales readily in oxidizing atmosphere  
 (c)— Sensitive to sulphur corrosion

# Specifying RTDs



A resistance temperature detector (RTD) operates on the principle that electrical resistance of metal changes as its temperature changes. The resistance of the sensing element increases as the temperature rises. There are two basic RTD designs wire wound and thin film. Wire wound design is a platinum sensing wire wound into a coil and housed in a ceramic mandrel to protect the coil. The thin film design consists of platinum deposited on a ceramic substrate and trimmed to achieve the desired alpha the construction is then covered with glass and epoxy to protect platinum film. Thin films are manufactured much in the same way as computer chips

The metal that is employed in a RTD must change resistance with respect to temperature and provide stability and a high output. The three metals that best exhibit these characteristics are:

## Platinum

The stability and linearity of this metals' resistive output over a broad range makes it the best metal for process type RTD's. Platinum can withstand oxidation and is effective over a range of -200 to + 850 degrees C. The four basic ohm values of 100, 200, 500 and 1000 give the user different degrees of sensitivity within the sensor. The higher the ohm value the greater the sensitivity and resolution. See chart on page 8 for the resistance change per degree Celsius for the temperature coefficient of resistance (TCR) for the RTD you are using.

## Copper

The greatest strength of this metal is its low cost. Copper performs poorly in oxidizing atmospheres and has a low output and thus an inability to perform in narrow measuring spans.

## Nickel

This metal is a good compromise between copper and platinum. It has a higher output and is slightly less expensive than platinum. It is extremely nonlinear above 300 degrees C.

RTDs are known for their excellent accuracy and linearity over a wide temperature range. Some RTDs have accuracies as high as 0.01 ohms (0.026°C) at 0°C. RTDs are also extremely stable devices. Common industrial RTDs drift less than 0.1°C/year. Manufacturing processes increasingly require precise process control. For this reason the number of RTDs installed annually continues to grow as a percentage of total temperature sensor sales.

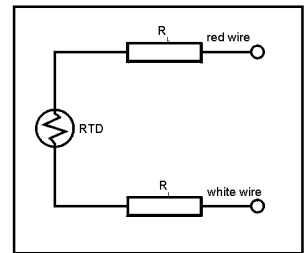
Because an RTD is a passive resistive device, you must pass a current through the device to produce a measurable voltage. This current causes the RTD to internally heat, which appears as

an error. You can minimize self-heating by using the smallest possible excitation current. The typical RTD receiving device uses 1 mA to stimulate the RTD.

RTDs are available in two-, three-, and four-wire configurations. The number of lead wires directly affects such factors as accuracy, stability, installation budget and distance between sensor and receiver.

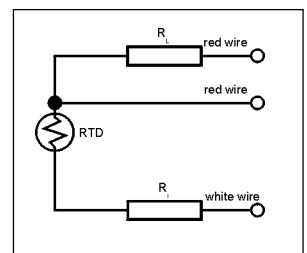
## Two Wire

When accuracy is not critical, a two-wire RTD is the least expensive; offering. Using lead wires to place any distance between a two-wire RTD and a receiving device will further compromise its accuracy. The potential for poor accuracy from a two-wire RTD stems from its inability to compensate for lead length, resistance that changes the ohm value of the original signal. A two-wire RTD should be used only in applications where the receiving device connects directly to the sensor.



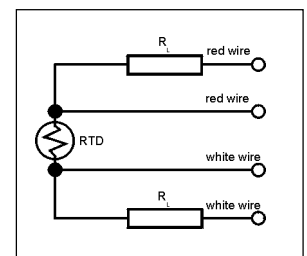
## Three Wire RTD

Three-wire RTDs compensate for resistance resulting from length differences by adding a third lead to the RTD. To accomplish this requires that the wires match exactly. Any difference in resistance between the lead wires will cause an imbalance, which will compromise the accuracy of the RTD. Lead length variance, work hardening or corrosion, and manufacturing irregularities are errors to avoid. Quality manufacturing is critical to insure balance of all three leads.



## Four Wire RTD

Errors caused by resistance imbalance between leads are cancelled out in a four-wire RTD circuit. Four-wire RTDs are used where superior accuracy is critical or if the sensor is installed far from the receiving device. In a four-wire RTD one pair of wires carries the current through the RTD the other pair senses the voltage across the RTD. 2- and three-wire RTDs require heavier lead wire because thicker wire, by creating less resistance to the measured



signal, reduces measurement distortion. Therefore lighter gauge wire, less expensive, may be used in four-wire RTD applications.

RTDs are limited to temperatures of 1200 ° F and because of the construction of the sensing element, RTDs do not do well in high-vibration and severe mechanical shock environments. When selecting a temperature sensor for an application you should consult your temperature sensor manufacturer for recommendations.

## RTD Characteristics

**Stability:** Defined as the ability of a sensor to maintain its stated accuracy over an extended period of time, usually one year, at its rated temperature. RTDs when used properly can maintain a stability of .25°

**Repeatability:** Defined as the ability to repeat the same output value at a given temperature point in a spanned temperature range. RTDs typically are repeatable to  $\pm .14^{\circ}\text{C}$  or .05%, whichever is greater.

**Response Time:** Measured as the time necessary for a sensor to report a 63.2% step change in temperature in water moving transverse to the sensor sheath at 3 fps.

### Sheath Diameter

1/8"  
3/16"  
1/4"

### Response Time

2 Seconds  
3 Seconds  
5 Seconds

**Accuracy:** The industry has standardized on two types of accuracy for Platinum 100 ohm RTD elements. They are Class B, the standard in the process industry and the higher accuracy Class A. The table below shows typical element accuracies per DIN 43760-1980 and ASTM E1137.

### Platinum (100 ohm)

Temperature		Accuracy			
		Class B Standard		Class A High	
°C	°F	°C	°F	°C	°F
-100	-148	.8	1.44	.35	.63
0	32	.3	.54	.15	.27
100	212	.8	1.44	.35	.63
200	392	1.3	2.34	.55	.99
300	572	1.8	3.24	.75	1.35
400	752	2.3	4.14	.95	1.71
500	932	2.8	5.04	1.15	2.07

### Standard Accuracy Nickel (120 ohm)

Rt	Temperature		Tolerance		
	(°C)	°C	°F	±°C	±°F
70.83	-73	-100	1.25	2.25	.825
120.00	0	32	.83	1.50	.600
148.07	38	100	1.30	2.34	1.020
200.64	100	212	2.10	3.76	1.910
247.82	149	300	2.68	4.75	2.700
380.31	260	500	4.28	7.71	5.520

### Optional High Accuracy Nickel (120 ohm)

Rt	Temperature		Tolerance		
	(°C)	°C	°F	±°C	±°F
70.83	-73	-100	.84	1.52	.55
120.00	0	32	.56	1.00	.40
148.07	38	100	.88	1.58	.68
200.64	100	212	1.39	2.51	1.27
247.82	149	300	1.79	3.23	1.82
380.31	260	500	2.62	4.71	3.68

### Standard Accuracy - Copper (9.035 ohms @ 0 °C / 10 ohms @ 25 °C)

Rt	Temperature		Tolerance		
	(°C)	°C	°F	±°C	±°F
6.190	-73	-100	2.83	5.09	.112
9.035	0	32	1.14	2.05	.045
10.000	25	77	1.56	2.80	.056
10.490	38	100	2.12	3.82	.084
12.897	100	212	3.53	6.36	.196
14.780	149	300	4.94	8.90	.140
19.116	260	500	7.78	14.00	.308

### Optional High Accuracy - Copper (9.035 ohms @ 0 °C / 10 ohms @ 25 °C)

Rt	Temperature		Tolerance		
	(°C)	°C	°F	±°C	±°F
6.190	-73	-100	1.04	1.87	.040
9.035	0	32	.44	.73	.016
10.000	25	77	.56	1.00	.020
10.490	38	100	.66	1.19	.030
12.897	100	212	1.25	2.25	.050
14.780	149	300	1.72	3.09	.070
19.116	260	500	2.74	4.94	.011

### Temperature Coefficient of Resistance (TCR)

The temperature coefficient of a sensor is determined by the purity of the winding wire used in the manufacture of the sensor element. It is defined as the resistance change per ohm per degree C. Our standard RTDs use the following TCRs:

Platinum = Curve A = .00392 ohms/ohm/°C  
 Curve B = .003850 ohms/ohm/°C  
 Nickel = .006720 ohms/ohm/°C  
 Copper = .004274 ohms/ohm/°C

### Sensor Resistance Change per Degree at 0°C (32°F)

Sensor Resistance	°C	°F
100 ohm Platinum	.39 ohms	.22 ohms
200 ohm Platinum	.78 ohms	.44 ohms
400 ohm Platinum	1.56 ohms	.88 ohms
500 ohm Platinum	1.95 ohms	1.10 ohms
1000 ohm Platinum	3.90 ohms	2.20 ohms
120 ohm Nickel	.72 ohms	.40 ohms
10 ohm Copper	.039 ohms	.02 ohms
100 ohm Copper	.39 ohms	.22 ohms



# Thermocouple and RTD MI Cable Specifications



## Single Thermocouple MI Cable Specifications

<b>Cable Diameter</b>	(inch)	<b>0.059</b>	<b>0.062</b>	<b>0.079</b>	<b>0.118</b>	<b>0.125</b>	<b>0.177</b>	<b>0.188</b>	<b>0.236</b>	<b>0.250</b>	<b>0.313</b>	<b>0.375</b>	<b>0.425</b>	<b>0.500</b>
	(mm)	<b>1.5</b>	<b>1.6</b>	<b>2.0</b>	<b>3.0</b>	<b>3.2</b>	<b>4.5</b>	<b>4.8</b>	<b>6.0</b>	<b>6.4</b>	<b>8.0</b>	<b>9.5</b>	<b>10.8</b>	<b>12.7</b>
<b>Wire Diameter</b>	(inch)	0.010	0.010	0.013	0.019	0.021	0.029	0.031	0.039	0.041	0.051	0.062	0.070	0.082
	(mm)	0.25	0.25	0.33	0.48	0.53	0.74	0.79	0.99	1.04	1.30	1.57	1.78	2.08
<b>Gage Equivalent</b> (approximate)		<30	>30	>28	>25	>24	>21	<20	<18	>18	>16	<14	<13	>12
<b>Sheath Wall Thickness</b>	(inch)	0.007	0.007	0.009	0.013	0.014	0.020	0.021	0.027	0.029	0.036	0.043	0.049	0.057
	(mm)	0.18	0.18	0.23	0.33	0.36	0.51	0.53	0.69	0.74	0.91	1.09	1.24	1.45



## Duplex Thermocouple MI Cable Specifications

<b>Cable Diameter</b>	(inch)	<b>0.118</b>	<b>0.125</b>	<b>0.177</b>	<b>0.188</b>	<b>0.234</b>	<b>0.236</b>	<b>0.250</b>	<b>0.313</b>	<b>0.375</b>	<b>0.425</b>	<b>0.500</b>
	(mm)	<b>3.0</b>	<b>3.2</b>	<b>4.5</b>	<b>4.8</b>	<b>5.94</b>	<b>6.0</b>	<b>6.4</b>	<b>8.0</b>	<b>9.5</b>	<b>10.8</b>	<b>12.7</b>
<b>Wire Diameter</b>	(inch)	0.018	0.019	0.027	0.029	0.036	0.036	0.038	0.048	0.057	0.065	0.076
	(mm)	0.46	0.48	0.69	0.74	0.91	0.91	0.97	1.22	1.45	1.65	1.93
<b>Gage Equivalent</b> (approximate)		>25	<24	<21	>21	>19	>19	<18	>17	15	>14	>13
<b>Sheath Wall Thickness</b>	(inch)	0.013	0.014	0.020	0.021	0.027	0.027	0.029	0.036	0.043	0.049	0.057
	(mm)	0.33	0.36	0.51	0.53	0.69	0.69	0.74	0.91	1.09	1.24	1.45



## Triplex Thermocouple MI Cable Specifications

<b>Cable Diameter</b>	(inch)	<b>0.188</b>	<b>0.236</b>	<b>0.250</b>	<b>0.313</b>	<b>0.375</b>	<b>0.425</b>	<b>0.500</b>
	(mm)	<b>4.8</b>	<b>6.0</b>	<b>6.4</b>	<b>8.0</b>	<b>9.5</b>	<b>10.8</b>	<b>12.7</b>
<b>Wire Diameter</b>	(inch)	0.021	0.026	0.028	0.035	0.042	0.048	0.056
	(mm)	0.53	0.66	0.71	0.89	1.07	1.22	1.42
<b>Gage Equivalent</b> (approximate)		>24	>22	<21	<19	>18	<16	<15
<b>Sheath Wall Thickness</b>	(inch)	0.021	0.027	0.029	0.036	0.043	0.049	0.057
	(mm)	0.53	0.69	0.74	0.91	1.09	1.24	1.45



## Three or Four Wire RTD MI Cable Specifications

<b>Cable Diameter</b>	(inch)	<b>0.090</b>	<b>0.118</b>	<b>0.125</b>	<b>0.177</b>	<b>0.188</b>	<b>0.236</b>	<b>0.250</b>	<b>0.313</b>	<b>0.375</b>	<b>0.425</b>	<b>0.500</b>
	(mm)	<b>2.3</b>	<b>3.0</b>	<b>3.2</b>	<b>4.5</b>	<b>4.8</b>	<b>6.0</b>	<b>6.4</b>	<b>8.0</b>	<b>9.5</b>	<b>10.8</b>	<b>12.7</b>
<b>Wire Diameter</b>	(inch)	0.010	0.013	0.014	0.020	0.021	0.026	0.028	0.035	0.042	0.047	0.055
	(mm)	0.25	0.33	0.36	0.51	0.53	0.66	0.71	0.89	1.07	1.19	1.40
<b>Gage Equivalent</b> (approximate)		>30	>28	27	24	>24	>22	<21	<19	>18	>17	<15
<b>Sheath Wall Thickness</b>	(inch)	0.008	0.010	0.011	0.015	0.016	0.020	0.021	0.027	0.032	0.036	0.043
	(mm)	0.19	0.25	0.28	0.38	0.41	0.51	0.53	0.69	0.81	0.91	1.09



## Dual Three Wire RTD MI Cable Specifications

<b>Cable Diameter</b>	(inch)	<b>0.188</b>	<b>0.236</b>	<b>0.250</b>	<b>0.313</b>	<b>0.375</b>	<b>0.425</b>	<b>0.500</b>
	(mm)	<b>4.8</b>	<b>6.0</b>	<b>6.4</b>	<b>8.0</b>	<b>9.5</b>	<b>10.8</b>	<b>12.7</b>
<b>Wire Diameter</b>	(inch)	0.021	0.026	0.028	0.035	0.042	0.047	0.055
	(mm)	0.53	0.66	0.71	0.89	1.07	1.19	1.40
<b>Gage Equivalent</b> (approximate)		>24	>22	<21	<19	>18	>17	<15
<b>Sheath Wall Thickness</b>	(inch)	0.016	0.020	0.021	0.027	0.032	0.036	0.043
	(mm)	0.41	0.51	0.53	0.69	0.81	0.91	1.09

**Note:** IR Test Voltage of 500 VDC applied to all above listed cables. Cable dimensions shown are nominal. Actual dimensions may vary within tolerance limits. Specifications subject to change without notice.

## Choosing the right sensor for the job

Criteria	Thermocouple vs. RTD	TC	RTD
<b>Range</b>	Although new and improved manufacturing techniques have increased the range of RTDs, this category belongs to thermocouples. Better than 95% of RTDs are used in temperatures below 1000° F. Thermocouples can be used up to 2700° F.	<b>X</b>	
<b>Sensitivity</b>	Grounded thermocouples are inherently tip sensitive; while RTD elements are isolated from their sheaths. A grounded thermocouple will respond to a 63% step change in temperature nearly three times faster than an RTD.	<b>X</b>	
<b>Cost</b>	Comparing a 12 inch, SS sheath .25", Type J grounded thermocouple, with a 100 Ohm platinum RTD .00385 Alpha, prices the thermocouple at 2.5 to 3 times less than an RTD.  Installed cost make up some of this difference since RTDs use inexpensive copper lead wire to transmit the signal back to the DCS.	<b>X</b>	
<b>Accuracy</b>	There are many factors to determine accuracy; linearity, stability, and repeatability to name a few that can affect accuracy. While a thermocouple's stand alone accuracy can approach that of an RTD, the superior advantages in these other areas make the RTD the choice.		<b>X</b>
<b>Linearity</b>	Temperature vs. resistance nearly plot a straight line for an RTD, while a thermocouple shows an almost "S" like curve.		<b>X</b>
<b>Ruggedness</b>	Thermocouples can essentially be one piece. RTD elements both thin film and wire wound must be connected to copper wire.	<b>X</b>	
<b>Stability</b>	Due to their linearity and virtually drift free output, RTDs are more stable than thermocouples.		<b>X</b>
<b>Repeatability</b>	The ability of a probe or instrument to give the same output or reading under repeated identical conditions.		<b>X</b>

# Thermowell and Protection Tube Specification

## Common Materials:

The following materials are the most common alloys used as thermowells or protection tubes. (Temperature ratings in the following guideline are expressed in °F)

**Carbon Steel (A105, A350, CF2)** - Commonly used in oxidizing environments. Its melting point is 2500° and maximum operating temperature is 1300°.

**304 SS** - Used in applications up to 1650°. This nickel based alloy has good corrosion resistance and can be used in both reducing and oxidizing atmospheres.

**310 SS** - Better than 304 in many high temperature applications. Good resistance to carburizing and reducing environments. Subject to carbide precipitation in the 900° to 1600° range. Continuous service to 2100°.

**316 SS** - Operating temperature is the same as 304 but has a higher corrosion resistance and creep strength. OK to use in both reducing and oxidizing atmospheres.

**446 SS** - Most commonly used ferritic stainless steel. Maximum operating temperature is 2000°. Selected for use in reducing, oxidizing, vacuum and neutral atmospheres.

**Low Carbon Stainless Steels** - Are available from SSi in 304L and 316L. The operating and melt temperatures of these alloys are the same as the standard 304 and 316SS. They are generally used to reduce the effect of carbide precipitation.

**Alloy 600** - Maximum rating of 2100°. This alloy has excellent corrosion resistance at elevated temperatures. Not recommended in reducing or high sulfur environments.

**Alloy 800** - Same elevated temperature resistance to oxidation as Alloy 600. Good sulfur and corrosion resistance. Same operating temperature as Alloy 600.

**Hastelloy B** - Can be used up to 1500° in inert atmospheres and 1500° in oxidizing environments. Excellent resistance to pitting, stress-corrosion cracking.

**Hastelloy C** - Excellent corrosion resistance to ferric and cupric chlorides, contaminated mineral acids, wet chlorine gas. Oxidation resistance to 1800°F. Continuous service to 2200°.

**Monel** - Good resistance to sea water and not subject to chloride stress cracking. Not recommended for oxidizing atmospheres. Upper temperature range is 1000°.

**Nickel** - Use in sulfur free environments and in oxidizing atmospheres. Operating temperature not to exceed 1400°.

**Tantalum** - Upper temperature range is 5000°. Most commonly used as a sheath material for stainless flanged wells. Has good resistance to corrosion to most chemicals and a high heat conductivity coefficient.

## Design Considerations:

### Material - Cost versus Corrosion

In general the most important consideration in selecting the proper thermowell is the material of construction. Given that pressure is not a consideration, the wrong material selection can cause premature failure due to corrosion. In a perfect world, tantalum would be the same price as carbon steel and consequently seldom would there be a cost versus corrosion consideration. But then, a

perfect world would have eliminated the nice little corrosion chart guide on pages 69 and 70 of this manual. The high polish on all stainless steel and nickel alloys reduces the risk of corrosion.

### Connection - The Process Decides

The industry has standardized on five different types of process connections. They are: Threaded, Flanged, Socket Weld, Weld-In, and Van Stone. *Threaded Wells* are provided in one piece construction (up to 36") and have an NPT connection. *Flanged Wells* (other than Van Stone) consist of a stem welded to an ANSI rated flange. The weld is commonly referred to as a double weld that eliminates crevice corrosion since no open joints are exposed. *Socket Weld Wells* fit all A.S.A. standard couplings and flanges, are easy to install and have a very tight fit. *Weld-In Wells* are more expensive to install and are used where flanges are not practical or desired. *Van Stone Wells* are a one-piece construction well installed with a lap joint flange.

### Length - More than just a "U" dimension

The immersion length of a well typically referred to as the "U" dimension is measured from the bottom of the threads or flange to the tip of the well. Accuracy of the sensor can be affected by the immersion length of the well. Thermocouples, which are tip sensitive, are less likely to be affected by short "U" lengths; while RTD's which are stem sensitive would require a longer "U" for the same process condition. A rule of thumb is to immerse a thermocouple at least 3" in gases and 1" in liquids. Add 2" to this rule for RTD's.

### Bore Size - Standardization is the Key

The standard bore size for all wells offered in this catalog is .260 with .385 available as an option. Delivery is not generally affected by the .385 Wide Bore (WB) option. These bore sizes will accommodate most sheathed thermocouples, RTD's and thermometers.

### Well Shank - Strength is the Key

Tapered wells provide greater protection against breaking in high velocity fluid applications. The higher strength to weight ratio makes tapered the choice over straight wells due to their natural higher frequency. Reduced tip or step down wells provide increased sensitivity.

### Vibration - Sometimes very dangerous

Excess pressure, temperature and corrosion are the major causes of well failure. Vibration, although less common, is significantly more dangerous. A condition called the Von Karman Trail can be caused by fluid flowing by the well which forms a turbulent wake. This wake has a frequency which is based on the diameter of the well and the velocity of the fluid. If this wake frequency is the same as the natural frequency of the well, the resonance could cause the well to vibrate to the extent that the stem fractures and breaks. It is difficult to provide specific information in chart form to assist you in well selection when vibration is a consideration. Maximum allowable velocities will change depending on the "U" length, well material, temperature, type of fluid and well construction. For example a 316SS well with a 3-1/2" U can handle a maximum velocity of 100 feet per second in water at 200°F. The same well in 1000°F superheated steam allows 375 feet per second. Smart Sensors can perform the necessary calculations to assist you with design criteria in cases where vibration may be a factor. Smart Sensor assumes no responsibility other than repair or replacement of a well.

*\*The information contained herein acts as a guide and Smart Sensors Inc., distributors and representatives specifically deny warranty expressed or implied.*

## Thermowells: Why They Fail

The following is the most common cause of failure for threaded or flanged bar stock thermowells:

- Improper process application
- Improper material selection
- Improper installation
- Higher than anticipated temperatures
- Ignoring velocity considerations

Generally there are warnings associated with the impending failure for all of the failure considerations except for velocity. This failure can result in the thermowell moving unrestricted to a most undesirable alternative location in the process.

This most catastrophic cause of failure comes from improper velocity considerations. When a well is installed in a pipe or vessel and as fluid flows past the well's tip it forms a turbulent wake, this wake is called the Von Karman Trail. This wake has a defined frequency based on the diameter of the well and the velocity of the fluid flowing past it. The well must possess sufficient stiffness so that its frequency would never equal the wake frequency of the Von Karman Trail. If these frequencies are equal to one another it causes the well to vibrate to the point of breaking.

The following table provides the maximum velocity for a 1" NPT threaded well, tapered construction, either 304 or 316SS. The medium is water at 200 degrees F in a pressurized (2500 psi) vessel. The maximum velocity and corresponding U length should be used as a guide only.

The calculations for determining U length are sophisticated and complete. Never use a guide or guess when it comes to determining whether velocity can cause a catastrophic failure. Call Smart Sensors for complete calculations based on your specific criteria.

U Length in inches	Maximum velocity (fps)
3.5	109
6	64
8	47
10	38
12	31
18	18
24	10

Smart Sensors can perform the velocity calculations that will determine the maximum U length and type of well. To make this recommendation we will need the following information:

- 1) Design U length in inches
- 2) Maximum velocity in feet per second
- 3) Maximum temperature
- 4) Well material
- 5) Process fluid or gas

## Ceramic and Metal Protection Tubes

These protection tubes are generally used in industrial furnace applications where the temperature prohibits use of a metal tube. The characteristics of Alumina, Mullite, Silicon Carbide and Metal Ceramic protection tubes are as different as the applications they perform well in. Selection of the type of tube is application dependent, the following is a broad definition of some of the successful applications:

Molten Metal Calcining kilns	Molten Glass Ethylene Crackers	Oil fired furnaces Blast furnaces
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### Alumina

The chemical composition consists of greater than 99.6% of sintered Alumina Oxide. They are the toughest ceramic tube when compared to Mullite. Alumina is extremely versatile and can be used in all atmospheres with selected preference in oxidizing atmospheres where in general Mullite would be a better choice. This tube can be used with any thermocouple calibration including all noble metal calibrations.

### Mullite

Silica/Alumina protection tubes are a low cost alternative to Alumina. They have a low tolerance to thermal shock and can only be used with J, K, and N thermocouples. It is recommended that the tubes are evenly heated to 800 degrees F prior to use.

### Silicon Carbide

Silicon Carbide, Carbon and Silica comprise the majority of the chemical composition and provide an excellent resistance to shock. Resistance to corrosion and abrasion at temperatures above the range of nickel chrome alloys is a feature that allows use in the most demanding corrosive application – which includes molten salt. An inner alumina tube must be used when noble metal thermocouples are employed.

### Metal Ceramic

Consisting of chromium and alumina oxide this tube holds its strength even under load conditions. In most applications it can be mounted horizontally without drooping. The conductivity of this composite is comparable to most stainless steels. Its use in molten metal applications is recommended since it has good resistance to wetting.

<b>KEY</b>
<b>E - Excellent</b>
<b>G - Good</b>
<b>A - Average</b>
<b>P - Poor</b>
<b>Y - Yes</b>
<b>N - No</b>

	Temp Rating °C	Gas Tight	Corrosion Resistance	Resistance to Thermal Shock	Thermal Conductivity	Hardness	Droop	Water Absorption	Cost	Oxidizing Atmosphere
Alumina Oxide (99.7% Pure)	1950	Y	A	P	P	P	P	E	\$\$	N
Mullite (Silica/Alumina)	1750	Y	A	P	P	A	P	E	\$	Y
Metal Ceramic (Chromium/Aluminum Oxide)	1320	Y	G	E	E	G	E	E	\$\$\$	N
Hexaloy (Silicon Carbide)	1650	Y	E	E	E	E	G	E	\$\$\$\$	Y

# Specifying Temperature Sensors in Hazardous Areas

A great concern to those who specify instruments is the safety of the installation in hazardous areas. This guide will help the user define these locations and specify the proper sensor enclosure in accordance to nationally accepted standards.

The following list of acronyms are a sampling of the testing laboratories and standard institutes in North America that deal with standards and testing of materials used in hazardous areas.

<b>ANSI</b>	American National Standards Institute
<b>CSA</b>	Canadian Standards Association
<b>FM</b>	Factory Mutual Research Corporation
<b>I. S.</b>	Intrinsically Safe
<b>ISA</b>	Instrument Systems and Automation
<b>NEC</b>	National Electric Code
<b>NEMA</b>	National Electrical Manufacturers Association
<b>NFPA</b>	National Fire Protection Association
<b>UL</b>	Underwriters Laboratories

This guide is not intended to define hazardous locations. However it will provide insight to sensor enclosures designed to function in hazardous areas. In North America the NEC divides flammable gases in to three classes:

- Gases
- Dusts
- Fibers

The *classes* are further divided into *groups*. The *groups* are organized by the explosive potential of the material within the group. The following table lists the class with an example of some of the materials in the group.

<b>Class I:</b> Flammable gases and vapors	<b>Group A:</b> Acetylene <b>Group B:</b> Hydrogen, butadiene, ethylene oxide, propylene oxide <b>Group C:</b> Ethylene, coke oven gas, diethyl ether, dimethyl ether <b>Group D:</b> Propane, acetone, alcohols, ammonia, benzene, butane, ethane, ethyl acetate, gasoline, heptanes, hexanes, methane, octanes, pentanes, toluene.
<b>Class II:</b> Combustible dusts	<b>Group E:</b> Metal dust <b>Group F:</b> Coal, coke dust <b>Group G:</b> Grain, plastic dust
<b>Class III:</b> Combustible flyings and fibers	Wood flyings, paper fibers, cotton fibers

The third and final consideration of the standards is the probability of the presence of the materials as identified by the groups that are incorporated into the three classes. This area is broken down into two separate Divisions. Division identification is thorough and complicated but basically subscribes to the following guidelines:

- Division I:** Areas where hazardous materials may be present under normal operating conditions
- Division II:** Areas where hazardous materials may become present due to leaks, process upsets or failures

In reviewing the two areas the probability of an explosion is more prevalent where explosive gases or dust are present in the process. Consequently Division I is defined as a hazardous location by standard institutions.

Today's instrumentation is more consistent and reliable than instruments used a decade ago, greatly reducing the chances of a spill or process upset. Also specifications that call for non redundant technologies to prevent process upsets like spills have reduced the possibility of catastrophic occurrences in Division II areas. Although Division II areas are classified as nonhazardous, for safety reasons many users prefer to use Division I products in Division II areas. In general because of the low energy produced, non passive devices such as thermocouples and RTDs should be safe in Division II areas.

In summary there are three methods of protection for temperature sensors in Division I areas. They are:

- Explosion proof housings
- Intrinsically safe loops
- Purged or safe instrument air

This guide has pretty much described the hazardous area and the following are the enclosures (heads) available from Smart Sensors along with the NEMA rating and the areas that we recommend their use:

## Explosion Proof

*For use in:*

**Class I  
Division I  
Groups B, C, and D**

**Class II  
Division I  
Groups E, F, and G**



NEMA - 4



NEMA - 4X

## NEMA Protection Ratings

In North America, Equipment can be classified per the National Electrical Manufacturer's Association (NEMA) Enclosure Classifications. NEMA is a nonprofit trade organization composed of mainly U.S. manufacturers of electrical apparatus. NEMA created voluntary standards for electrical enclosures. These classifications describe the environment in which the product can be used due to the protection the enclosure provides. ("Enclosure" includes electrical and mechanical connections and external adjustments.) Among others, NEMA classifies enclosures based on the effects of external icing, rust and corrosion, or contamination from oil and coolants.

Type 1	General Purpose	Indoor	accidental contact will not corrode
Type 2	Drip-proof	Indoor	limited amounts of falling water and dirt will not corrode
Type 3	Dust-tight, rain-tight	Outdoor	windblown dust, rain, sleet, and undamaged by external ice formation
Type 3R	Dust-tight, rain-tight	Outdoor	same as type 3 above, plus diverts water from live parts, provision for drainage, will not corrode
Type 3S	Dust-tight, rain-tight	Outdoors	same as type 3 above, operation of external mechanism when ice laden, will not corrode
Type 4	Water-tight, dust-tight	Indoor/Outdoor	windblown dust and rain, splashing water, and hose directed water, undamaged by ice formation, will not corrode
Type 4X	Water-tight, dust-tight	Indoor/Outdoor	same as type 4 above, plus corrode resistant, will not corrode
Type 5	Dust-tight	Indoor	dust and falling dirt, will not corrode
Type 6	Water-tight/dust-tight	Indoor/Outdoor	temporary entry of water during limited submersion (6ft/2m for 30 Min), undamaged by formation of ice, will not corrode
Type 6P	Water-tight/dust-tight	Indoor/Outdoor	same as type 6 above plus prolonged submersion, will not corrode
Type 7	Explosion proof/Class I Groups A, B, C, D	Indoor	Hazardous Locations: Protection against corrosive effects of liquids and gases
Type 8	Explosion proof/Class I	Indoor/Outdoor	Hazardous Locations: protection against corrosive effects of liquids and gases; contacts or connections immersed in oil
Type 9	Explosion Proof/Class II Groups E or G	Indoor	Hazardous Locations: dust-tight, hazardous dust
Type 10	Hazardous Locations	Indoor	U.S. MSHA Mine Safety and Health Adm. per 30 C.F.R., Part 18
Type 11	Oil-tight/Corrode	Indoor	protection from corrosive effects of gases and liquid dripping, seepage and external condensation or corrosion, oil immersion
Type 12	Oil-tight/Dust-tight	Indoor	fibers, lint, dust and light splashing, seepage and dripping condensation or non-corrosive liquids
Type 12K		Indoor	same as type 12 above, enclosure has knockouts
Type 13	Oil-tight/Dust-tight	Indoor	dust, spraying of water, oil and corrosive coolant, oil resistant gaskets

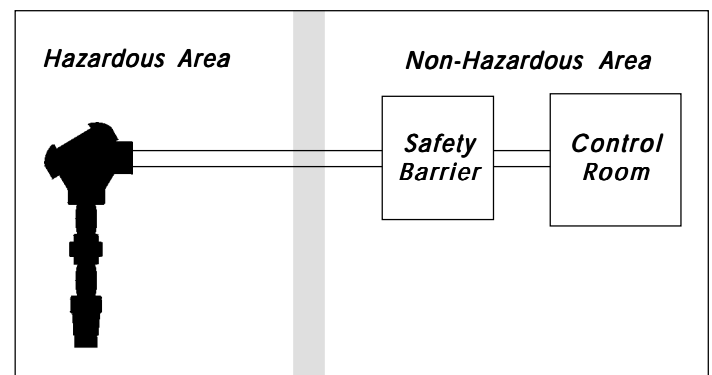
The final area for discussion regarding protection in hazardous areas is intrinsically safe loops.

Intrinsically safe equipment is defined as "equipment and wiring which is incapable of releasing sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous atmospheric mixture in its most easily ignited concentration." (ISA-RP12.6) This is achieved by limiting the amount of power available to the electrical equipment in the hazardous area to a level below that which will ignite the gases.

Since RTDs and thermocouples are low energy devices they lend themselves useful in intrinsically safe loops. By definition these sensors do not possess the energy to ignite a material that could cause an explosion. A temperature loop is determined to be intrinsically safe if it is incapable of ignition under four conditions:

- Normal power levels
- Faults in the control room
- Faults in the signal wiring
- Faults in the sensor

No explosion proof housings are required in intrinsically safe temperature loops, consequently this can result in a significant cost savings to the user. However since most receiving instruments are AC powered, they can release stray voltage through the instrument wire to the field sensor. The use of Zener barriers prevents explosions due to this scenario and certifies the loop as intrinsically safe.



Please visit our web site for other solutions to **Temperature Measurement.....the right way!!!!**

# Improving Process Temperature Measurements

A common misconception when trying to improve temperature measurement is to focus on accuracy. In the case of thermocouples the knee jerk reaction is to change the accuracy from standard to special limits (while remaining with the initial calibration). Special limits cut the accuracy in half for non noble metal calibrations.

There are a few problems associated with this approach. First the measuring or controlling instrument may not be able to read or control the improved accuracy; consequently there may be a cost to upgrade the instrument part of the measurement loop. Second the cost for upgrading to special limits may be prohibitive. Third, the repeatability, which we will define as the ability of the thermocouple to reproduce a consistent output under the same process conditions, may provide the desired results at a lower cost.

The other option when considering accuracy only is to change the calibration. Thermocouple accuracy or inaccuracy is attributed to the inhomogeneities in alloy composition. The optimum thermocouple configuration is to match two pure element legs. Noble metal combinations of gold versus platinum and platinum versus palladium can provide accuracy improvements ten times greater than non noble metal configurations, but are extremely expensive.

What are the alternatives? First let's examine the special limits accuracy of the most commonly used sheathed thermocouple calibration.

Calibration: ANSI type K  
Positive Conductor: Chromel  
Negative Conductor: Alumel  
Accuracy @ 500 degrees C  
Special Tolerance: + or - 2 degrees C

In the above case we can assume that the millivolt output of a type K thermocouple with special tolerance put in service at 500 degrees C will read no lower than 498 or no higher than 502 degrees Centigrade. This produces a four degree uncertainty. Cross Calibration is an option available to improve loop accuracy without incurring all the expense associated with special tolerance calibration. For the purpose of this examination we will assume that identical thermocouple calibrations are involved.

## Two areas particularly warrant Cross Calibration consideration, they are:

1. Multiple identical thermocouples installed close to one another in the process or multiple thermocouples that share the same process environment
2. Multiple thermocouples located in the same protection tube commonly referred to as multi-point assemblies.

## How does Cross Calibration work?

As stated earlier thermocouple accuracy is dependent on alloy composition. Consequently thermocouples made from the same alloy composition have identical inaccuracies. Identifying the error from a single alloy composition batch assures the user that

all thermocouples made from that batch have a repeatable error. In many cases error compensation can be accomplished in the instrument that processes the millivolt signal from the thermocouple.

## Why does Cross Calibration work?

Quite simply thermocouples can experience the same degradation when exposed to the same process conditions. This is particularly relevant in multi-point assemblies responsible for reporting reactor temperatures. In the case of sensors not in close proximity the use of analytic redundancy (see footnote) correlations may help the user to understand how to optimize accuracy.

Of course the ability to measure the millivolt output of the thermocouple in a controlled environment is essential in order to employ Cross Calibration.

Contact Smart Sensors and inquire about our calibration lab. Measurement error of thermocouples in our lab can be up to 5 times greater than ANSI accuracies and is NIST traceable.

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## Analytic Redundancy

*Yung, S.K. and Clarke, D.W. "Local Sensor Validation," Measurement and Control, Vol. 22, June 1989, pp. 122-130.*

## Improve Accuracy – Reduce Noise

Sensor accuracy can be affected by interference from common industrial noise sources. Thermocouple and RTD outputs are low level signals. The thermocouple produces output in millivolts, while the RTD produces a very weak resistance signal. Ungrounded thermocouples, where the conductors are insulated from the sheath can provide protection from some noise sources. The RTD is inherently isolated. But at times radio frequency and electro magnetic interference from walkie-talkies, transformers, motors and power wires can still cause erratic signals even if the sensor is ungrounded or isolated. Converting the output to 4-20 milli-amps by using a field temperature transmitter can reduce noise problems. Smart Sensors offers a transmitter that provides RFI and EMI protection. More importantly all of our field transmitters are isolated. Isolation protects against power surges or errors associated with ground loops.



**For more information, Request Smart Bulletin PB-pt-1**

# Calibration

Verifying the accuracy of Thermocouples and RTDs is a difficult but exact science. It requires a system that has a stable temperature source, an accurate reference thermometer, repeatable measurement and control and finally a data processor. Each component of the system must be in concert with the other components in order to minimize system uncertainty. The components must have corresponding supportive characteristics for resolution, accuracy, linearity, traceability, stability and repeatability. Examples of how these specifications can affect system uncertainty are:

## Resolution and Accuracy

If desired accuracy is .01 degrees C then the resolution or ability to read this accuracy must be at least .001 degree C.

## Linearity

It is tempting to state linear accuracy at one temperature (usually 0 degrees C), while this is helpful (all thermocouples have zero



output at this temperature) it is important to know the measurement accuracy over the entire range of the readout. If the readout were perfectly linear, its accuracy specification would be the same across its entire range. However, all readout devices have some non-linearity component and are not perfectly linear

## Stability

Readout stability is important, since most measurements are made in a wide variety of ambient conditions and over varying lengths of time. Consequently the temperature coefficient and long-term stability specifications are extremely important.

## Calibration

Beware of "no calibration" claims. Latest ISO specifications require calibration at least once annually.

## Traceability

A manufacturers' calibration tolerance is at best at a secondary standard level. It is important for the reference thermometer to have NIST traceable accuracy.

Now lets' put this all together. It all starts with the ability to maintain the desired calibration temperature. In order to provide the optimum stability two sources are necessary. This is due to the broad range of temperatures involved. In general if a RTD is being tested a temperature bath would be used. If the sensor is a thermocouple with a higher temperature range a furnace is used. Depending upon the source employed the stability ranges from .0001 degrees C to .5 degrees C. Achieving this type of stability requires a highly stable control sensing element, fast maximum stability, and a source design that minimizes and controls heat loss.

Since our calibration procedure employs the comparison method, the need for a highly accurate reference thermometer is essential. Our system uses a Standard Platinum Resistance Thermometer (SPRT) with accuracies of better than + or - .002 degrees C. This accuracy is achieved by abiding by the International Temperature Scale – ITS-90. The SPRT has accuracies traceable to NIST.

The final element, the processor allows the information to be formatted into a user defined report and can analytically address the tolerance and accuracy of the sensor. A good example is the Callendar Van Duesen (CVD) equation. The system uses CVD equations and applies associated uncertainties of a Platinum Resistance Detector over any point within its operating temperature range. The result is a report that provides a resistance limit of error function. The practical uses of this report are many, but one of the most useful is determining sensor resistance interchangeability as a function of temperature. Simply stated this allows the user to determine uncertainty within a predetermined range and correct for the error in the instrument.

Our ability to put together the high tech components that have the characteristics necessary to assure uncertainty data is an important element in our success. The system is fully integrated into our quality assurance program and is a testament to our motto... ***Temperature measurement...the right way!***





-340 °F - 200 °F

Type J - Iron vs Constantan

-210 °C - 100 °C

°F	EMF in Millivolts — Reference Junction 32°F										°F	°C	EMF in Millivolts — Reference Junctions 0 °C										°C		
	0	-1	-2	-3	-4	-5	-6	-7	-8	-9			-10	0	-1	-2	-3	-4	-5	-6	-7	-8		-9	-10
-340	-8.030	-8.041	-8.052	-8.063	-8.074	-8.085	-8.095					-340	-210	-8.095											-210
-330	-7.915	-7.927	-7.938	-7.950	-7.962	-7.973	-7.985	-7.996	-8.008	-8.019	-8.030	-330	-200	-7.890	-7.912	-7.934	-7.955	-7.976	-7.996	-8.017	-8.037	-8.057	-8.076	-8.095	-200
-320	-7.791	-7.804	-7.816	-7.829	-7.841	-7.854	-7.866	-7.878	-7.890	-7.903	-7.915	-320													
-310	-7.659	-7.672	-7.686	-7.699	-7.713	-7.726	-7.739	-7.752	-7.765	-7.778	-7.791	-310													
-300	-7.519	-7.534	-7.548	-7.562	-7.576	-7.604	-7.618	-7.632	-7.645	-7.659		-300	-190	-7.659	-7.683	-7.707	-7.731	-7.755	-7.778	-7.801	-7.824	-7.846	-7.868	-7.890	-190
-290	-7.373	-7.388	-7.403	-7.417	-7.432	-7.447	-7.462	-7.476	-7.491	-7.505	-7.519	-290	-180	-7.403	-7.429	-7.456	-7.482	-7.508	-7.534	-7.559	-7.585	-7.610	-7.634	-7.659	-180
-280	-7.219	-7.234	-7.250	-7.265	-7.281	-7.296	-7.312	-7.327	-7.342	-7.357	-7.373	-280													
-270	-7.058	-7.074	-7.090	-7.107	-7.123	-7.139	-7.155	-7.171	-7.187	-7.203	-7.219	-270	-170	-7.123	-7.152	-7.181	-7.209	-7.237	-7.265	-7.293	-7.321	-7.348	-7.376	-7.403	-170
-260	-6.890	-6.907	-6.924	-6.941	-6.958	-6.975	-6.991	-7.008	-7.025	-7.041	-7.058	-260													
-250	-6.716	-6.734	-6.752	-6.769	-6.787	-6.804	-6.821	-6.839	-6.856	-6.873	-6.890	-250	-160	-6.821	-6.853	-6.883	-6.914	-6.944	-6.975	-7.005	-7.035	-7.064	-7.094	-7.123	-160
-240	-6.536	-6.555	-6.573	-6.591	-6.609	-6.627	-6.645	-6.663	-6.681	-6.699	-6.716	-240	-150	-6.500	-6.533	-6.566	-6.598	-6.631	-6.663	-6.695	-6.727	-6.759	-6.790	-6.821	-150
-230	-6.351	-6.370	-6.388	-6.407	-6.426	-6.444	-6.463	-6.481	-6.500	-6.518	-6.536	-230													
-220	-6.159	-6.179	-6.198	-6.217	-6.236	-6.255	-6.275	-6.294	-6.313	-6.332	-6.351	-220													
-210	-5.962	-5.982	-6.002	-6.022	-6.042	-6.061	-6.081	-6.101	-6.120	-6.140	-6.159	-210	-140	-6.159	-6.194	-6.229	-6.263	-6.298	-6.332	-6.366	-6.400	-6.433	-6.467	-6.500	-140
-200	-5.760	-5.781	-5.801	-5.821	-5.842	-5.862	-5.882	-5.902	-5.922	-5.942	-5.962	-200	-130	-5.801	-5.838	-5.874	-5.910	-5.946	-5.982	-6.018	-6.054	-6.089	-6.124	-6.159	-130
-190	-5.553	-5.574	-5.595	-5.616	-5.637	-5.657	-5.678	-5.698	-5.719	-5.740	-5.760	-190	-120	-5.426	-5.465	-5.503	-5.541	-5.578	-5.616	-5.653	-5.690	-5.727	-5.764	-5.801	-120
-180	-5.341	-5.363	-5.384	-5.405	-5.426	-5.448	-5.469	-5.490	-5.511	-5.532	-5.553	-180													
-170	-5.125	-5.146	-5.168	-5.190	-5.212	-5.233	-5.255	-5.277	-5.298	-5.320	-5.341	-170	-110	-5.037	-5.076	-5.115	-5.153	-5.191	-5.230	-5.272	-5.311	-5.350	-5.388	-5.426	-110
-160	-4.903	-4.926	-4.948	-4.970	-4.992	-5.015	-5.037	-5.059	-5.081	-5.103	-5.125	-160													
-150	-4.678	-4.701	-4.724	-4.746	-4.769	-4.791	-4.814	-4.836	-4.859	-4.881	-4.903	-150	-100	-4.633	-4.674	-4.714	-4.755	-4.796	-4.836	-4.877	-4.917	-4.957	-4.997	-5.037	-100
-140	-4.449	-4.472	-4.495	-4.518	-4.541	-4.564	-4.587	-4.610	-4.633	-4.655	-4.678	-140													
-130	-4.215	-4.239	-4.262	-4.286	-4.309	-4.332	-4.356	-4.379	-4.402	-4.425	-4.449	-130	-90	-4.215	-4.257	-4.300	-4.342	-4.384	-4.425	-4.467	-4.509	-4.550	-4.591	-4.633	-90
-120	-3.978	-4.002	-4.026	-4.050	-4.073	-4.097	-4.121	-4.144	-4.168	-4.192	-4.215	-120													
-110	-3.737	-3.761	-3.786	-3.810	-3.834	-3.858	-3.882	-3.906	-3.930	-3.954	-3.978	-110	-80	-3.786	-3.829	-3.872	-3.916	-3.959	-4.002	-4.045	-4.088	-4.130	-4.173	-4.215	-80
-100	-3.493	-3.517	-3.542	-3.566	-3.591	-3.615	-3.640	-3.664	-3.688	-3.713	-3.737	-100	-70	-3.344	-3.389	-3.434	-3.478	-3.522	-3.566	-3.610	-3.654	-3.698	-3.742	-3.786	-70
-90	-3.245	-3.270	-3.295	-3.320	-3.344	-3.369	-3.394	-3.419	-3.443	-3.468	-3.493	-90	-60	-2.893	-2.938	-2.984	-3.029	-3.075	-3.120	-3.165	-3.210	-3.255	-3.300	-3.344	-60
-80	-2.994	-3.019	-3.044	-3.070	-3.095	-3.120	-3.145	-3.170	-3.195	-3.220	-3.245	-80	-50	-2.431	-2.478	-2.524	-2.571	-2.617	-2.663	-2.709	-2.755	-2.801	-2.847	-2.893	-50
-70	-2.740	-2.766	-2.791	-2.817	-2.842	-2.867	-2.893	-2.918	-2.943	-2.969	-2.994	-70													
-60	-2.483	-2.509	-2.535	-2.560	-2.586	-2.612	-2.638	-2.663	-2.689	-2.714	-2.740	-60													
-50	-2.223	-2.249	-2.275	-2.301	-2.327	-2.353	-2.379	-2.405	-2.431	-2.457	-2.483	-50													
-40	-1.961	-1.987	-2.013	-2.040	-2.066	-2.092	-2.118	-2.145	-2.171	-2.197	-2.223	-40													
-30	-1.695	-1.722	-1.749	-1.775	-1.802	-1.828	-1.855	-1.881	-1.908	-1.934	-1.961	-30													
-20	-1.428	-1.455	-1.482	-1.508	-1.535	-1.562	-1.589	-1.615	-1.642	-1.669	-1.695	-20													
-10	-1.158	-1.185	-1.212	-1.239	-1.266	-1.293	-1.320	-1.347	-1.374	-1.401	-1.428	-10													
0	-0.886	-0.913	-0.940	-0.967	-0.995	-1.022	-1.049	-1.076	-1.104	-1.131	-1.158	0													
0	-0.886	-0.858	-0.831	-0.803	-0.776	-0.749	-0.721	-0.694	-0.666	-0.639	-0.611	0	0	0.000	-0.050	-0.101	-0.151	-0.201	-0.251	-0.301	-0.351	-0.401	-0.451	-0.501	0
10	-0.611	-0.583	-0.556	-0.528	-0.501	-0.473	-0.445	-0.418	-0.390	-0.362	-0.334	10													
20	-0.334	-0.307	-0.279	-0.251	-0.223	-0.195	-0.168	-0.140	-0.112	-0.084	-0.056	20													
30	-0.056	-0.028	0.000	0.028	0.056	0.084	0.112	0.140	0.168	0.196	0.223	30													
40	0.225	0.253	0.281	0.309	0.337	0.365	0.394	0.422	0.450	0.478	0.507	40	0	0.000	0.050	0.101	0.151	0.202	0.253	0.303	0.354	0.405	0.456	0.507	0
50	0.507	0.535	0.563	0.592	0.620	0.649	0.677	0.705	0.734	0.762	0.791	50	10	0.507	0.558	0.609	0.660	0.711	0.762	0.814	0.865	0.916	0.968	1.019	10
60	0.791	0.819	0.848	0.876	0.905	0.933	0.962	0.991	1.019	1.048	1.076	60	20	1.019	1.071	1.122	1.174	1.226	1.277	1.329	1.381	1.433	1.485	1.537	20
70	1.076	1.105	1.134	1.162	1.191	1.220	1.249	1.277	1.306	1.335	1.364	70	30	1.537	1.589	1.641	1.693	1.745	1.797	1.849	1.902	1.954	2.006	2.059	30
80	1.364	1.392	1.421	1.450	1.479	1.508	1.537	1.566	1.594	1.623	1.652	80	40	2.059	2.111	2.164	2.216	2.269	2.322	2.374	2.427	2.480	2.532	2.585	40
90	1.652	1.681	1.710	1.739	1.768	1.797	1.826	1.855	1.884	1.913	1.942	90													
100	1.942	1.972	2.001	2.030	2.059	2.088	2.117	2.146	2.175	2.205	2.234	100													
110	2.234	2.263	2.292	2.322	2.351	2.380	2.409	2.439	2.468	2.497	2.527	110													
120	2.527	2.556	2.585	2.615	2.644	2.673	2.703	2.732	2.762	2.791	2.821	120	50	2.585	2.638	2.691	2.744	2.797	2.850	2.903	2.956	3.009	3.062	3.116	50
130	2.821	2.850	2.880	2.909	2.938	2.968	2.997	3.027	3.057	3.086	3.116	130	60	3.116	3.169	3.222	3.275	3.329	3.382	3.436	3.489	3.543	3.596	3.650	60
140	3.116	3.145	3.175	3.204	3.234	3.264	3.293	3.323	3.353	3.382	3.412	140	70	3.650	3.703	3.757	3.810	3.864	3.918	3.971	4.025	4.079	4.133	4.187	70
150	3.412	3.442	3.471	3.501	3.531	3.560	3.590	3.620	3.650	3.679	3.709	150	80	4.187	4.240	4.294	4.348	4.402	4.456	4.510	4.564	4.618	4.672	4.726	80
160	3.709	3.739	3.769	3.798	3.828	3.858	3.888	3.918	3.948	3.977	4.007	160	90	4.726	4.781	4.835	4.889	4.943	4.997	5.052	5.106	5.160	5.215	5.269	90
170	4.007	4.037	4.067	4.097	4.127	4.157	4.187	4.217	4.246	4.276	4.306	170													
180	4.306	4.336	4.366	4.396	4.426	4.456	4.486	4.516	4.546	4.576	4.606	180													
190	4.606	4.636	4.666	4.696	4.726	4.757	4.787	4.817																	

°F	0	1	2	3	4	5	6	7	8	9	10	°F	°C	0	1	2	3	4	5	6	7	8	9	10	°C
EMF in Millivolts — Reference Junction 32°F																									
200	4.907	4.937	4.967	4.997	5.028	5.058	5.088	5.118	5.148	5.178	5.209	200	100	5.269	5.323	5.378	5.432	5.487	5.541	5.595	5.650	5.705	5.759	5.814	100
210	5.209	5.239	5.269	5.299	5.329	5.360	5.390	5.420	5.450	5.480	5.511	210	110	5.814	5.868	5.923	5.977	6.032	6.087	6.141	6.196	6.251	6.306	6.360	110
220	5.511	5.541	5.571	5.602	5.632	5.662	5.692	5.723	5.753	5.783	5.814	220	120	6.360	6.415	6.470	6.525	6.579	6.634	6.689	6.744	6.799	6.854	6.909	120
230	5.814	5.844	5.874	5.905	5.935	5.965	5.996	6.026	6.056	6.087	6.117	230	130	6.909	6.964	7.019	7.074	7.129	7.184	7.239	7.294	7.349	7.404	7.459	130
240	6.117	6.147	6.178	6.208	6.239	6.269	6.299	6.330	6.360	6.391	6.421	240	140	7.459	7.514	7.569	7.624	7.679	7.734	7.789	7.844	7.900	7.955	8.010	140
250	6.421	6.452	6.482	6.512	6.543	6.573	6.604	6.634	6.665	6.695	6.726	250	150	8.010	8.065	8.120	8.175	8.231	8.286	8.341	8.396	8.452	8.507	8.562	150
260	6.726	6.756	6.787	6.817	6.848	6.878	6.909	6.939	6.970	7.000	7.031	260	160	8.562	8.618	8.673	8.728	8.783	8.839	8.894	8.949	9.005	9.060	9.115	160
270	7.031	7.061	7.092	7.122	7.153	7.184	7.214	7.245	7.275	7.306	7.336	270	170	9.115	9.171	9.226	9.282	9.337	9.392	9.448	9.503	9.559	9.614	9.669	170
280	7.336	7.367	7.398	7.428	7.459	7.489	7.520	7.550	7.581	7.612	7.642	280	180	9.669	9.725	9.780	9.836	9.891	9.947	10.002	10.057	10.113	10.168	10.224	180
290	7.642	7.673	7.704	7.734	7.765	7.795	7.826	7.857	7.887	7.918	7.949	290	190	10.224	10.279	10.335	10.390	10.446	10.501	10.557	10.612	10.668	10.723	10.779	190
300	7.949	7.979	8.010	8.041	8.071	8.102	8.133	8.163	8.194	8.225	8.255	300	200	10.779	10.834	10.890	10.945	11.001	11.056	11.112	11.167	11.223	11.278	11.334	200
310	8.255	8.286	8.317	8.347	8.378	8.409	8.439	8.470	8.501	8.532	8.562	310	210	11.334	11.389	11.445	11.501	11.556	11.612	11.667	11.723	11.778	11.834	11.889	210
320	8.562	8.593	8.624	8.654	8.685	8.716	8.747	8.777	8.808	8.839	8.869	320	220	11.889	11.945	12.000	12.056	12.111	12.167	12.222	12.278	12.334	12.389	12.445	220
330	8.869	8.900	8.931	8.962	8.992	9.023	9.054	9.085	9.115	9.146	9.177	330	230	12.445	12.500	12.556	12.611	12.667	12.722	12.778	12.833	12.889	12.944	13.000	230
340	9.177	9.208	9.238	9.269	9.300	9.331	9.362	9.392	9.423	9.454	9.485	340	240	13.000	13.056	13.111	13.167	13.222	13.278	13.333	13.389	13.444	13.500	13.555	240
350	9.485	9.515	9.546	9.577	9.608	9.639	9.669	9.700	9.731	9.762	9.793	350	250	13.555	13.611	13.666	13.722	13.777	13.833	13.888	13.944	13.999	14.055	14.110	250
360	9.793	9.823	9.854	9.885	9.916	9.947	9.977	10.008	10.039	10.070	10.101	360	260	14.110	14.166	14.221	14.277	14.332	14.388	14.443	14.499	14.554	14.609	14.665	260
370	10.101	10.131	10.162	10.193	10.224	10.255	10.285	10.316	10.347	10.378	10.409	370	270	14.665	14.720	14.776	14.831	14.887	14.942	14.998	15.053	15.109	15.164	15.219	270
380	10.409	10.440	10.470	10.501	10.532	10.563	10.594	10.625	10.655	10.686	10.717	380	280	15.219	15.275	15.330	15.386	15.441	15.496	15.552	15.607	15.663	15.718	15.773	280
390	10.717	10.748	10.779	10.810	10.840	10.871	10.902	10.933	10.964	10.995	11.025	390	290	15.773	15.829	15.884	15.940	15.995	16.050	16.106	16.161	16.216	16.272	16.327	290
400	11.025	11.056	11.087	11.118	11.149	11.180	11.211	11.241	11.272	11.303	11.334	400	300	16.327	16.383	16.438	16.493	16.549	16.604	16.659	16.715	16.770	16.825	16.881	300
410	11.334	11.365	11.396	11.426	11.457	11.488	11.519	11.550	11.581	11.612	11.642	410	310	16.881	16.936	16.991	17.046	17.102	17.157	17.212	17.268	17.323	17.378	17.434	310
420	11.642	11.673	11.704	11.735	11.766	11.797	11.828	11.858	11.889	11.920	11.951	420	320	17.434	17.489	17.544	17.599	17.655	17.710	17.765	17.820	17.876	17.931	17.986	320
430	11.951	11.982	12.013	12.044	12.074	12.105	12.136	12.167	12.198	12.229	12.260	430	330	17.986	18.041	18.097	18.152	18.207	18.262	18.318	18.373	18.428	18.483	18.538	330
440	12.260	12.290	12.321	12.352	12.383	12.414	12.445	12.476	12.506	12.537	12.568	440	340	18.538	18.594	18.649	18.704	18.759	18.814	18.870	18.925	18.980	19.035	19.090	340
450	12.568	12.599	12.630	12.661	12.691	12.722	12.753	12.784	12.815	12.846	12.877	450	350	19.090	19.146	19.201	19.256	19.311	19.366	19.422	19.477	19.532	19.587	19.642	350
460	12.877	12.907	12.938	12.969	13.000	13.031	13.062	13.093	13.123	13.154	13.185	460	360	19.642	19.697	19.753	19.808	19.863	19.918	19.973	20.028	20.083	20.139	20.194	360
470	13.185	13.216	13.247	13.278	13.308	13.339	13.370	13.401	13.432	13.463	13.494	470	370	20.194	20.249	20.304	20.359	20.414	20.469	20.525	20.580	20.635	20.690	20.745	370
480	13.494	13.524	13.555	13.586	13.617	13.648	13.679	13.709	13.740	13.771	13.802	480	380	20.745	20.800	20.855	20.911	20.966	21.021	21.076	21.131	21.186	21.241	21.297	380
490	13.802	13.833	13.864	13.894	13.925	13.956	13.987	14.018	14.049	14.079	14.110	490	390	21.297	21.352	21.407	21.462	21.517	21.572	21.627	21.683	21.738	21.793	21.848	390
500	14.110	14.141	14.172	14.203	14.233	14.264	14.295	14.326	14.357	14.388	14.418	500	400	21.848	21.903	21.958	22.013	22.068	22.123	22.178	22.233	22.288	22.343	22.398	400
510	14.418	14.449	14.480	14.511	14.542	14.573	14.604	14.634	14.665	14.696	14.727	510	410	22.398	22.453	22.508	22.563	22.618	22.673	22.728	22.783	22.838	22.893	22.948	410
520	14.727	14.757	14.788	14.819	14.850	14.881	14.911	14.942	14.973	15.004	15.035	520	420	22.948	23.003	23.058	23.113	23.168	23.223	23.278	23.333	23.388	23.443	23.498	420
530	15.035	15.065	15.096	15.127	15.158	15.189	15.219	15.250	15.281	15.312	15.343	530	430	23.498	23.553	23.608	23.663	23.718	23.773	23.828	23.883	23.938	23.993	24.048	430
540	15.343	15.373	15.404	15.435	15.466	15.496	15.527	15.558	15.589	15.620	15.650	540	440	24.048	24.103	24.158	24.213	24.268	24.323	24.378	24.433	24.488	24.543	24.598	440
550	15.650	15.681	15.712	15.743	15.773	15.804	15.835	15.866	15.897	15.927	15.958	550	450	24.598	24.653	24.708	24.763	24.818	24.873	24.928	24.983	25.038	25.093	25.148	450
560	15.958	15.989	16.020	16.050	16.081	16.112	16.143	16.173	16.204	16.235	16.266	560	460	25.148	25.203	25.258	25.313	25.368	25.423	25.478	25.533	25.588	25.643	25.698	460
570	16.266	16.296	16.327	16.358	16.389	16.419	16.450	16.481	16.512	16.542	16.573	570	470	25.698	25.753	25.808	25.863	25.918	25.973	26.028	26.083	26.138	26.193	26.248	470
580	16.573	16.604	16.635	16.665	16.696	16.727	16.758	16.788	16.819	16.850	16.881	580	480	26.248	26.303	26.358	26.413	26.468	26.523	26.578	26.633	26.688	26.743	26.798	480
590	16.881	16.911	16.942	16.973	17.003	17.034	17.065	17.096	17.126	17.157	17.188	590	490	26.798	26.853	26.908	26.963	27.018	27.073	27.128	27.183	27.238	27.293	27.348	490
600	17.188	17.219	17.249	17.280	17.311	17.341	17.372	17.403	17.434	17.464	17.495	600	500	27.348	27.403	27.458	27.513	27.568	27.623	27.678	27.733	27.788	27.843	27.898	500
610	17.495	17.526	17.556	17.587	17.618	17.649	17.679	17.710	17.741	17.771	17.802	610	510	27.898	27.953	28.008	28.063	28.118	28.173	28.228	28.283	28.338	28.393	28.448	510
620	17.802	17.833	17.863	17.894	17.925	17.955	17.986	18.017	18.048	18.078	18.109	620	520	28.448	28.503	28.558	28.613	28.668	28.723	28.778	28.833	28.888	28.943	29.000	520
630	18.109	18.140	18.170	18.201	18.232	18.262	18.293	18.324	18.354	18.385	18.416	630	530	29.000	29.055	29.110	29.165	29.220	29.275	29.330	29.385	29.440	29.495	29.550	

700 °F - 1200 °F

Type J - Iron vs Constantan

400 °C - 700 °C

°F	EMF in Millivolts — Reference Junction 32°F										°F	°C	EMF in Millivolts — Reference Junctions 0 °C										°C		
	0	1	2	3	4	5	6	7	8	9			10	0	1	2	3	4	5	6	7	8		9	10
700	20.255	20.286	20.316	20.347	20.378	20.408	20.439	20.469	20.500	20.531	20.561	700	400	21.848	21.903	21.958	22.014	22.069	22.124	22.179	22.234	22.289	22.345	22.400	400
710	20.561	20.592	20.623	20.653	20.684	20.715	20.745	20.776	20.806	20.837	20.868	710	410	22.400	22.455	22.510	22.565	22.620	22.676	22.731	22.786	22.841	22.896	22.952	410
720	20.868	20.898	20.929	20.960	20.990	21.021	21.052	21.082	21.113	21.143	21.174	720	420	22.952	23.007	23.062	23.117	23.172	23.228	23.283	23.338	23.393	23.449	23.504	420
730	21.174	21.205	21.235	21.266	21.297	21.327	21.358	21.389	21.419	21.450	21.480	730	430	23.504	23.559	23.614	23.670	23.725	23.780	23.835	23.891	23.946	24.001	24.057	430
740	21.480	21.511	21.542	21.572	21.603	21.634	21.664	21.695	21.726	21.756	21.787	740	440	24.057	24.112	24.167	24.223	24.278	24.333	24.389	24.444	24.499	24.555	24.610	440
750	21.787	21.817	21.848	21.879	21.909	21.940	21.971	22.001	22.032	22.063	22.093	750	450	24.610	24.665	24.721	24.776	24.832	24.887	24.943	24.998	25.053	25.109	25.164	450
760	22.093	22.124	22.154	22.185	22.216	22.246	22.277	22.308	22.338	22.369	22.400	760	460	25.164	25.220	25.275	25.331	25.386	25.442	25.497	25.553	25.608	25.664	25.720	460
770	22.400	22.430	22.461	22.492	22.522	22.553	22.584	22.614	22.645	22.676	22.706	770	470	25.720	25.775	25.831	25.886	25.942	25.998	26.053	26.109	26.165	26.220	26.276	470
780	22.706	22.737	22.768	22.798	22.829	22.860	22.890	22.921	22.952	22.982	23.013	780	480	26.276	26.332	26.387	26.443	26.499	26.555	26.610	26.666	26.722	26.778	26.834	480
790	23.013	23.044	23.074	23.105	23.136	23.166	23.197	23.228	23.258	23.289	23.320	790	490	26.834	26.889	26.945	27.001	27.057	27.113	27.169	27.225	27.281	27.337	27.393	490
800	23.320	23.350	23.381	23.412	23.442	23.473	23.504	23.535	23.565	23.596	23.627	800	500	27.393	27.449	27.505	27.561	27.617	27.673	27.729	27.785	27.841	27.897	27.953	500
810	23.627	23.657	23.688	23.719	23.749	23.780	23.811	23.842	23.872	23.903	23.934	810	510	27.953	28.010	28.066	28.122	28.178	28.234	28.291	28.347	28.403	28.460	28.516	510
820	23.934	23.964	23.995	24.026	24.057	24.087	24.118	24.149	24.180	24.210	24.241	820	520	28.516	28.572	28.629	28.685	28.741	28.798	28.854	28.911	28.967	29.024	29.080	520
830	24.241	24.272	24.303	24.333	24.364	24.395	24.426	24.456	24.487	24.518	24.549	830	530	29.080	29.137	29.194	29.250	29.307	29.363	29.420	29.477	29.534	29.590	29.647	530
840	24.549	24.579	24.610	24.641	24.672	24.702	24.733	24.764	24.795	24.826	24.856	840	540	29.647	29.704	29.761	29.818	29.874	29.931	29.988	30.045	30.102	30.159	30.216	540
850	24.856	24.887	24.918	24.949	24.979	25.010	25.041	25.072	25.103	25.134	25.164	850	550	30.216	30.273	30.330	30.387	30.444	30.502	30.559	30.616	30.673	30.730	30.788	550
860	25.164	25.195	25.226	25.257	25.288	25.318	25.349	25.380	25.411	25.442	25.473	860	560	30.788	30.845	30.902	30.960	31.017	31.074	31.132	31.189	31.247	31.304	31.362	560
870	25.473	25.504	25.534	25.565	25.596	25.627	25.658	25.689	25.720	25.750	25.781	870	570	31.362	31.419	31.477	31.535	31.592	31.650	31.708	31.766	31.823	31.881	31.939	570
880	25.781	25.812	25.843	25.874	25.905	25.936	25.967	25.998	26.029	26.059	26.090	880	580	31.939	31.997	32.055	32.113	32.171	32.229	32.287	32.345	32.403	32.461	32.519	580
890	26.090	26.121	26.152	26.183	26.214	26.245	26.276	26.307	26.338	26.369	26.400	890	590	32.519	32.577	32.636	32.694	32.752	32.810	32.869	32.927	32.985	33.044	33.102	590
900	26.400	26.431	26.462	26.493	26.524	26.555	26.586	26.617	26.648	26.679	26.710	900	600	33.102	33.161	33.219	33.278	33.337	33.395	33.454	33.513	33.571	33.630	33.689	600
910	26.710	26.741	26.772	26.803	26.834	26.865	26.896	26.927	26.958	26.989	27.020	910	610	33.689	33.748	33.807	33.866	33.925	33.984	34.043	34.102	34.161	34.220	34.279	610
920	27.020	27.051	27.082	27.113	27.144	27.175	27.206	27.237	27.268	27.299	27.330	920	620	34.279	34.338	34.397	34.457	34.516	34.575	34.635	34.694	34.754	34.813	34.873	620
930	27.330	27.362	27.393	27.424	27.455	27.486	27.517	27.548	27.579	27.610	27.642	930	630	34.873	34.932	34.992	35.051	35.111	35.171	35.230	35.290	35.350	35.410	35.470	630
940	27.642	27.673	27.704	27.735	27.766	27.797	27.829	27.860	27.891	27.922	27.953	940	640	35.470	35.530	35.590	35.650	35.710	35.770	35.830	35.890	35.950	36.010	36.071	640
950	27.953	27.985	28.016	28.047	28.078	28.109	28.141	28.172	28.203	28.234	28.266	950	650	36.071	36.131	36.191	36.252	36.312	36.373	36.433	36.494	36.554	36.615	36.675	650
960	28.266	28.297	28.328	28.359	28.391	28.422	28.453	28.485	28.516	28.547	28.579	960	660	36.675	36.736	36.797	36.858	36.918	36.979	37.040	37.101	37.162	37.223	37.284	660
970	28.579	28.610	28.641	28.672	28.704	28.735	28.767	28.798	28.829	28.861	28.892	970	670	37.284	37.345	37.406	37.467	37.528	37.590	37.651	37.712	37.773	37.835	37.896	670
980	28.892	28.923	28.955	28.986	29.018	29.049	29.080	29.112	29.143	29.175	29.206	980	680	37.896	37.958	38.019	38.081	38.142	38.204	38.265	38.327	38.389	38.450	38.512	680
990	29.206	29.238	29.269	29.301	29.332	29.363	29.395	29.426	29.458	29.489	29.521	990	690	38.512	38.574	38.636	38.698	38.760	38.822	38.884	38.946	39.008	39.070	39.132	690
1000	29.521	29.552	29.584	29.616	29.647	29.679	29.710	29.742	29.773	29.805	29.836	1000	700											700	
1010	29.836	29.868	29.900	29.931	29.963	29.995	30.026	30.058	30.089	30.121	30.153	1010													
1020	30.153	30.184	30.216	30.248	30.279	30.311	30.343	30.375	30.406	30.438	30.470	1020													
1030	30.470	30.502	30.533	30.565	30.597	30.629	30.660	30.692	30.724	30.756	30.788	1030													
1040	30.788	30.819	30.851	30.883	30.915	30.947	30.979	31.011	31.043	31.074	31.106	1040													
1050	31.106	31.138	31.170	31.202	31.234	31.266	31.298	31.330	31.362	31.394	31.426	1050													
1060	31.426	31.458	31.490	31.522	31.554	31.586	31.618	31.650	31.682	31.714	31.746	1060													
1070	31.746	31.778	31.811	31.843	31.875	31.907	31.939	31.971	32.003	32.035	32.068	1070													
1080	32.068	32.100	32.132	32.164	32.196	32.229	32.261	32.293	32.325	32.358	32.390	1080													
1090	32.390	32.422	32.455	32.487	32.519	32.551	32.584	32.616	32.648	32.681	32.713	1090													
1100	32.713	32.746	32.778	32.810	32.843	32.875	32.908	32.940	32.973	33.005	33.037	1100													
1110	33.037	33.070	33.102	33.135	33.167	33.200	33.232	33.265	33.298	33.330	33.363	1110													
1120	33.363	33.395	33.428	33.460	33.493	33.526	33.558	33.591	33.624	33.656	33.689	1120													
1130	33.689	33.722	33.754	33.787	33.820	33.853	33.885	33.918	33.951	33.984	34.016	1130													
1140	34.016	34.049	34.082	34.115	34.148	34.180	34.213	34.246	34.279	34.312	34.345	1140													
1150	34.345	34.378	34.411	34.444	34.477	34.509	34.542	34.575	34.608	34.641	34.674	1150													
1160	34.674	34.707	34.740	34.773	34.806	34.840	34.873	34.906	34.939	34.972	35.005	1160													
1170	35.005	35.038	35.071	35.104	35.138	35.171	35.204	35.237	35.270	35.304	35.337	1170													
1180	35.337	35.370	35.403	35.437	3																				

°F	0	1	2	3	4	5	6	7	8	9	10	°F	°C	0	1	2	3	4	5	6	7	8	9	10	°C
EMF in Millivolts — Reference Junction 32°F												EMF in Millivolts — Reference Junctions 0 °C													
1200	36.004	36.037	36.071	36.104	36.138	36.171	36.205	36.238	36.272	36.305	36.339	1200	700	39.132	39.194	39.256	39.318	39.381	39.443	39.505	39.568	39.630	39.693	39.755	700
1210	36.339	36.373	36.406	36.440	36.473	36.507	36.541	36.574	36.608	36.642	36.675	1210	710	39.755	39.818	39.880	39.943	40.005	40.068	40.131	40.193	40.256	40.319	40.382	710
1220	36.675	36.709	36.743	36.777	36.810	36.844	36.878	36.912	36.945	36.979	37.013	1220	720	40.382	40.445	40.508	40.570	40.633	40.696	40.759	40.822	40.886	40.949	41.012	720
1230	37.013	37.047	37.081	37.114	37.148	37.182	37.216	37.250	37.284	37.318	37.352	1230	730	41.012	41.075	41.138	41.201	41.265	41.328	41.391	41.455	41.518	41.581	41.645	730
1240	37.352	37.386	37.420	37.454	37.488	37.522	37.556	37.590	37.624	37.658	37.692	1240	740	41.645	41.708	41.772	41.835	41.899	41.962	42.026	42.090	42.153	42.217	42.281	740
1250	37.692	37.726	37.760	37.794	37.828	37.862	37.896	37.930	37.964	37.999	38.033	1250	750	42.281	42.344	42.408	42.472	42.536	42.599	42.663	42.727	42.791	42.855	42.919	750
1260	38.033	38.067	38.101	38.135	38.169	38.204	38.238	38.272	38.306	38.341	38.375	1260	760	42.919	42.983	43.047	43.111	43.175	43.239	43.303	43.367	43.431	43.495	43.559	760
1270	38.375	38.409	38.444	38.478	38.512	38.546	38.581	38.615	38.650	38.684	38.718	1270	770	43.559	43.624	43.688	43.752	43.817	43.881	43.945	44.010	44.074	44.139	44.203	770
1280	38.718	38.753	38.787	38.822	38.856	38.890	38.925	38.959	38.994	39.028	39.063	1280	780	44.203	44.267	44.332	44.396	44.461	44.525	44.590	44.655	44.719	44.784	44.848	780
1290	39.063	39.097	39.132	39.166	39.201	39.235	39.270	39.305	39.339	39.374	39.408	1290	790	44.848	44.913	44.977	45.042	45.107	45.171	45.236	45.301	45.365	45.430	45.494	790
1300	39.408	39.443	39.478	39.512	39.547	39.582	39.616	39.651	39.686	39.720	39.755	1300	800	45.494	45.559	45.624	45.688	45.753	45.818	45.882	45.947	46.011	46.076	46.141	800
1310	39.755	39.790	39.825	39.859	39.894	39.929	39.964	39.999	40.033	40.068	40.103	1310	810	46.141	46.205	46.270	46.334	46.399	46.464	46.528	46.593	46.657	46.722	46.786	810
1320	40.103	40.138	40.173	40.207	40.242	40.277	40.312	40.347	40.382	40.417	40.452	1320	820	46.786	46.851	46.915	46.980	47.044	47.109	47.173	47.238	47.302	47.367	47.431	820
1330	40.452	40.487	40.522	40.556	40.591	40.626	40.661	40.696	40.731	40.766	40.801	1330	830	47.431	47.495	47.560	47.624	47.688	47.753	47.817	47.881	47.946	48.010	48.074	830
1340	40.801	40.836	40.872	40.907	40.942	40.977	41.012	41.047	41.082	41.117	41.152	1340	840	48.074	48.138	48.202	48.267	48.331	48.395	48.459	48.523	48.587	48.651	48.715	840
1350	41.152	41.187	41.222	41.258	41.293	41.328	41.363	41.398	41.433	41.469	41.504	1350	850	48.715	48.779	48.843	48.907	48.971	49.034	49.098	49.162	49.226	49.290	49.353	850
1360	41.504	41.539	41.574	41.610	41.645	41.680	41.715	41.751	41.786	41.821	41.856	1360	860	49.353	49.417	49.481	49.544	49.608	49.672	49.735	49.799	49.862	49.926	49.989	860
1370	41.856	41.892	41.927	41.962	41.998	42.033	42.068	42.104	42.139	42.174	42.210	1370	870	49.989	50.052	50.116	50.179	50.243	50.306	50.369	50.432	50.495	50.559	50.622	870
1380	42.210	42.245	42.281	42.316	42.351	42.387	42.422	42.458	42.493	42.528	42.564	1380	880	50.622	50.685	50.748	50.811	50.874	50.937	51.000	51.063	51.126	51.188	51.251	880
1390	42.564	42.599	42.635	42.670	42.706	42.741	42.777	42.812	42.848	42.883	42.919	1390	890	51.251	51.314	51.377	51.439	51.502	51.565	51.627	51.690	51.752	51.815	51.877	890
1400	42.919	42.954	42.989	43.025	43.061	43.096	43.132	43.167	43.203	43.239	43.274	1400	900	51.877	51.940	52.002	52.064	52.127	52.189	52.251	52.314	52.376	52.438	52.500	900
1410	43.274	43.310	43.346	43.381	43.417	43.452	43.488	43.524	43.559	43.595	43.631	1410	910	52.500	52.562	52.624	52.686	52.748	52.810	52.872	52.934	52.996	53.057	53.119	910
1420	43.631	43.667	43.702	43.738	43.774	43.809	43.845	43.881	43.917	43.953	43.988	1420	920	53.119	53.181	53.243	53.304	53.366	53.427	53.489	53.550	53.612	53.673	53.735	920
1430	43.988	44.024	44.060	44.096	44.131	44.167	44.203	44.239	44.275	44.310	44.346	1430	930	53.735	53.796	53.857	53.919	53.980	54.041	54.102	54.164	54.225	54.286	54.347	930
1440	44.346	44.382	44.418	44.454	44.490	44.525	44.561	44.597	44.633	44.669	44.705	1440	940	54.347	54.408	54.469	54.530	54.591	54.652	54.713	54.773	54.834	54.895	54.956	940
1450	44.705	44.741	44.777	44.812	44.848	44.884	44.920	44.956	44.992	45.028	45.064	1450	950	54.956	55.016	55.077	55.138	55.198	55.259	55.319	55.380	55.440	55.501	55.561	950
1460	45.064	45.099	45.135	45.171	45.207	45.243	45.279	45.315	45.351	45.387	45.423	1460	960	55.561	55.622	55.682	55.742	55.803	55.863	55.923	55.983	56.043	56.104	56.164	960
1470	45.423	45.458	45.494	45.530	45.566	45.602	45.638	45.674	45.710	45.746	45.782	1470	970	56.164	56.224	56.284	56.344	56.404	56.464	56.524	56.584	56.643	56.703	56.763	970
1480	45.782	45.818	45.853	45.889	45.925	45.961	45.997	46.033	46.069	46.105	46.141	1480	980	56.763	56.823	56.883	56.942	57.002	57.062	57.121	57.181	57.240	57.300	57.360	980
1490	46.141	46.177	46.212	46.248	46.284	46.320	46.356	46.392	46.428	46.464	46.500	1490	990	57.360	57.419	57.479	57.538	57.597	57.657	57.716	57.776	57.835	57.894	57.953	990
1500	46.500	46.535	46.571	46.607	46.643	46.679	46.715	46.751	46.786	46.822	46.858	1500	700	39.132	39.194	39.256	39.318	39.381	39.443	39.505	39.568	39.630	39.693	39.755	700
1510	46.858	46.894	46.930	46.966	47.001	47.037	47.073	47.109	47.145	47.181	47.216	1510	710	39.755	39.818	39.880	39.943	40.005	40.068	40.131	40.193	40.256	40.319	40.382	710
1520	47.216	47.252	47.288	47.324	47.359	47.395	47.431	47.467	47.503	47.538	47.574	1520	720	40.382	40.445	40.508	40.570	40.633	40.696	40.759	40.822	40.886	40.949	41.012	720
1530	47.574	47.610	47.646	47.681	47.717	47.753	47.788	47.824	47.860	47.896	47.931	1530	730	41.012	41.075	41.138	41.201	41.265	41.328	41.391	41.455	41.518	41.581	41.645	730
1540	47.931	47.967	48.003	48.038	48.074	48.110	48.145	48.181	48.217	48.252	48.288	1540	740	41.645	41.708	41.772	41.835	41.899	41.962	42.026	42.090	42.153	42.217	42.281	740
1550	48.288	48.324	48.359	48.395	48.430	48.466	48.502	48.537	48.573	48.608	48.644	1550	750	42.281	42.344	42.408	42.472	42.536	42.599	42.663	42.727	42.791	42.855	42.919	750
1560	48.644	48.679	48.715	48.750	48.786	48.822	48.857	48.893	48.928	48.964	48.999	1560	760	42.919	42.983	43.047	43.111	43.175	43.239	43.303	43.367	43.431	43.495	43.559	760
1570	48.999	49.034	49.070	49.105	49.141	49.176	49.212	49.247	49.283	49.318	49.353	1570	770	43.559	43.624	43.688	43.752	43.817	43.881	43.945	44.010	44.074	44.139	44.203	770
1580	49.353	49.389	49.424	49.460	49.495	49.530	49.566	49.601	49.636	49.672	49.707	1580	780	44.203	44.267	44.332	44.396	44.461	44.525	44.590	44.655	44.719	44.784	44.848	780
1590	49.707	49.742	49.778	49.813	49.848	49.883	49.919	49.954	49.989	50.024	50.060	1590	790	44.848	44.913	44.977	45.042	45.107	45.171	45.236	45.301	45.365	45.430	45.494	790
1600	50.060	50.095	50.130	50.165	50.200	50.235	50.271	50.306	50.341	50.376	50.411	1600	800	45.494	45.559	45.624	45.688	45.753	45.818	45.882	45.947	46.011	46.076	46.141	800
1610	50.411	50.446	50.481	50.517	50.552	50.587	50.622	50.657	50.692	50.727	50.762	1610	810	46.141	46.205	46.270	46.334	46.399	46.464	46.528	46.593	46.657	46.722	46.786	810
1620	50.762	50.797	50.832	50.867	50.902	50.937	50.972	51.007	51.042	51.077	51.112	1620	820	46.786	46.										

1700 °F - 2192 °F

Type J - Iron vs Constantan

1000 °C - 1200 °C

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EMF in Millivolts — Reference Junction 32°F											EMF in Millivolts — Reference Junctions 0 °C														
°F	0	1	2	3	4	5	6	7	8	9	10	°F	°C	0	1	2	3	4	5	6	7	8	9	10	°C
<b>1700</b>	53.530	53.564	53.598	53.632	53.667	53.701	53.735	53.769	53.803	53.837	53.871	<b>1700</b>	1700	57.953	58.013	58.072	58.131	58.190	58.249	58.309	58.368	58.427	58.486	58.545	<b>1000</b>
1710	53.871	53.905	53.939	53.973	54.007	54.041	54.075	54.109	54.143	54.177	54.211	1710	1010	58.545	58.604	58.663	58.722	58.781	58.840	58.899	58.957	59.016	59.075	59.134	1010
1720	54.211	54.245	54.279	54.313	54.347	54.381	54.415	54.449	54.483	54.516	54.550	1720	1020	59.134	59.193	59.252	59.310	59.369	59.428	59.487	59.545	59.604	59.663	59.721	1020
1730	54.550	54.584	54.618	54.652	54.686	54.719	54.753	54.787	54.821	54.855	54.888	1730	1030	59.721	59.780	59.838	59.897	59.956	60.014	60.073	60.131	60.190	60.248	60.307	1030
1740	54.888	54.922	54.956	54.990	55.023	55.057	55.091	55.124	55.158	55.192	55.225	1740	1040	60.307	60.365	60.423	60.482	60.540	60.599	60.657	60.715	60.774	60.832	60.890	1040
<b>1750</b>	55.225	55.259	55.293	55.326	55.360	55.393	55.427	55.461	55.494	55.528	55.561	<b>1750</b>	1050	60.890	60.949	61.007	61.065	61.123	61.182	61.240	61.298	61.356	61.415	61.473	<b>1050</b>
1760	55.561	55.595	55.628	55.662	55.695	55.729	55.762	55.796	55.829	55.863	55.896	1760	1060	61.473	61.531	61.589	61.647	61.705	61.763	61.822	61.880	61.938	61.996	62.054	1060
1770	55.896	55.930	55.963	55.997	56.030	56.063	56.097	56.130	56.164	56.197	56.230	1770	1070	62.054	62.112	62.170	62.228	62.286	62.344	62.402	62.460	62.518	62.576	62.634	1070
1780	56.230	56.264	56.297	56.330	56.364	56.397	56.430	56.464	56.497	56.530	56.564	1780	1080	62.634	62.692	62.750	62.808	62.866	62.924	62.982	63.040	63.098	63.156	63.214	1080
1790	56.564	56.597	56.630	56.663	56.697	56.730	56.763	56.796	56.829	56.863	56.896	1790	1090	63.214	63.271	63.329	63.387	63.445	63.503	63.561	63.619	63.677	63.734	63.792	1090
<b>1800</b>	56.896	56.929	56.962	56.995	57.028	57.062	57.095	57.128	57.161	57.194	57.227	<b>1800</b>	1100	63.792	63.850	63.908	63.966	64.024	64.081	64.139	64.197	64.255	64.313	64.370	<b>1100</b>
1810	57.227	57.260	57.293	57.326	57.360	57.393	57.426	57.459	57.492	57.525	57.558	1810	1110	64.370	64.428	64.486	64.544	64.602	64.659	64.717	64.775	64.833	64.890	64.948	1110
1820	57.558	57.591	57.624	57.657	57.690	57.723	57.756	57.789	57.822	57.855	57.888	1820	1120	64.948	65.006	65.064	65.121	65.179	65.237	65.295	65.352	65.410	65.468	65.525	1120
1830	57.888	57.920	57.953	57.986	58.019	58.052	58.085	58.118	58.151	58.184	58.217	1830	1130	65.525	65.583	65.641	65.699	65.756	65.814	65.872	65.929	65.987	66.045	66.102	1130
1840	58.217	58.249	58.282	58.315	58.348	58.381	58.414	58.446	58.479	58.512	58.545	1840	1140	66.102	66.160	66.218	66.275	66.333	66.391	66.448	66.506	66.564	66.621	66.679	1140
<b>1850</b>	58.545	58.578	58.610	58.643	58.676	58.709	58.741	58.774	58.807	58.840	58.872	<b>1850</b>	<b>J</b>	66.679	66.737	66.794	66.852	66.910	66.967	67.025	67.082	67.140	67.198	67.255	<b>1150</b>
1860	58.872	58.905	58.938	58.971	59.003	59.036	59.069	59.101	59.134	59.167	59.199	1860	1150	66.679	66.737	66.794	66.852	66.910	66.967	67.025	67.082	67.140	67.198	67.255	1150
1870	59.199	59.232	59.265	59.297	59.330	59.363	59.395	59.428	59.460	59.493	59.526	1870	1160	67.255	67.313	67.370	67.428	67.486	67.543	67.601	67.658	67.716	67.773	67.831	1160
1880	59.526	59.558	59.591	59.623	59.656	59.689	59.721	59.754	59.786	59.819	59.851	1880	1170	67.831	67.888	67.946	68.003	68.061	68.119	68.176	68.234	68.291	68.348	68.406	1170
1890	59.851	59.884	59.916	59.949	59.982	60.014	60.047	60.079	60.112	60.144	60.177	1890	1180	68.406	68.463	68.521	68.578	68.636	68.693	68.751	68.808	68.865	68.923	68.980	1180
<b>1900</b>	60.177	60.209	60.242	60.274	60.307	60.339	60.371	60.404	60.436	60.469	60.501	<b>1900</b>	1190	68.980	69.037	69.095	69.152	69.209	69.267	69.324	69.381	69.439	69.496	69.553	1190
1910	60.501	60.534	60.566	60.599	60.631	60.663	60.696	60.728	60.761	60.793	60.826	1910	1200	69.553											1200
1920	60.826	60.858	60.890	60.923	60.955	60.987	61.020	61.052	61.085	61.117	61.149														
1930	61.149	61.182	61.214	61.246	61.279	61.311	61.343	61.376	61.408	61.440	61.473														
1940	61.473	61.505	61.537	61.570	61.602	61.634	61.667	61.699	61.731	61.763	61.796														
<b>1950</b>	61.796	61.828	61.860	61.893	61.925	61.957	61.989	62.022	62.054	62.086	62.118														
1960	62.118	62.151	62.183	62.215	62.247	62.280	62.312	62.344	62.376	62.409	62.441														
1970	62.441	62.473	62.505	62.537	62.570	62.602	62.634	62.666	62.699	62.731	62.763														
1980	62.763	62.795	62.827	62.860	62.892	62.924	62.956	62.988	63.020	63.053	63.085														
1990	63.085	63.117	63.149	63.181	63.214	63.246	63.278	63.310	63.342	63.374	63.406														
<b>2000</b>	63.406	63.439	63.471	63.503	63.535	63.567	63.599	63.632	63.664	63.696	63.728	<b>2000</b>	1200	69.553											1200
2010	63.728	63.760	63.792	63.824	63.856	63.889	63.921	63.953	63.985	64.017	64.049														
2020	64.049	64.081	64.113	64.146	64.178	64.210	64.242	64.274	64.306	64.338	64.370														
2030	64.370	64.402	64.435	64.467	64.499	64.531	64.563	64.595	64.627	64.659	64.691														
2040	64.691	64.723	64.756	64.788	64.820	64.852	64.884	64.916	64.948	64.980	65.012														
<b>2050</b>	65.012	65.044	65.076	65.109	65.141	65.173	65.205	65.237	65.269	65.301	65.333	<b>2050</b>													
2060	65.333	65.365	65.397	65.429	65.461	65.493	65.525	65.557	65.590	65.622	65.654	2060													
2070	65.654	65.686	65.718	65.750	65.782	65.814	65.846	65.878	65.910	65.942	65.974	2070													
2080	65.974	66.006	66.038	66.070	66.102	66.134	66.166	66.199	66.231	66.263	66.295	2080													
2090	66.295	66.327	66.359	66.391	66.423	66.455	66.487	66.519	66.551	66.583	66.615	2090													
<b>2100</b>	66.615	66.647	66.679	66.711	66.743	66.775	66.807	66.839	66.871	66.903	66.935	<b>2100</b>													
2110	66.935	66.967	66.999	67.031	67.063	67.095	67.127	67.159	67.191	67.223	67.255	2110													
2120	67.255	67.287	67.319	67.351	67.383	67.415	67.447	67.479	67.511	67.543	67.575	2120													
2130	67.575	67.607	67.639	67.671	67.703	67.735	67.767	67.799	67.831	67.863	67.895	2130													
2140	67.895	67.927	67.959	67.991	68.023	68.055	68.087	68.119	68.150	68.182	68.214	2140													
<b>2150</b>	68.214	68.246	68.278	68.310	68.342	68.374	68.406	68.438	68.470	68.502	68.534	<b>2150</b>													
2160	68.534	68.566	68.597	68.629	68.661	68.693	68.725	68.757	68.789	68.821	68.853	2160													
2170	68.853	68.884	68.916	68.948	68.980	69.012	69.044	69.076	69.108	69.139	69.171	2170													
2180	69.171	69.203	69.235	69.267	69.299	69.330	69.362	69.394	69.426	69.458	69.490	2180													
2190	69.490	69.521	69.553									2190													
°F	0	1	2	3	4	5	6	7	8	9															

-450 °F - 50 °F

Type K - Chromel vs Alumel

-270 °C - 10 °C

EMF in Millivolts — Reference Junction 32°F												EMF in Millivolts — Reference Junctions 0 °C													
°F	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	°F	°C	0	1	2	3	4	5	6	7	8	9	10	°C
-450	-6.456	-6.456	-6.457	-6.457	-6.458							-450	-270	-6.458											-270
-440	-6.446	-6.448	-6.449	-6.450	-6.451	-6.452	-6.453	-6.454	-6.454	-6.455	-6.456	-440	-260	-6.411	-6.444	-6.446	-6.448	-6.450	-6.452	-6.453	-6.455	-6.456	-6.457	-6.458	-260
-430	-6.431	-6.433	-6.435	-6.436	-6.438	-6.440	-6.441	-6.443	-6.444	-6.445	-6.446														
-420	-6.409	-6.411	-6.414	-6.416	-6.419	-6.421	-6.423	-6.425	-6.427	-6.429	-6.431														
-410	-6.380	-6.383	-6.386	-6.389	-6.392	-6.395	-6.398	-6.401	-6.404	-6.406	-6.409														
<b>-400</b>	<b>-6.344</b>	<b>-6.348</b>	<b>-6.352</b>	<b>-6.355</b>	<b>-6.359</b>	<b>-6.363</b>	<b>-6.366</b>	<b>-6.370</b>	<b>-6.373</b>	<b>-6.377</b>	<b>-6.380</b>	<b>-400</b>	<b>-250</b>	<b>-6.404</b>	<b>-6.408</b>	<b>-6.413</b>	<b>-6.417</b>	<b>-6.421</b>	<b>-6.425</b>	<b>-6.429</b>	<b>-6.432</b>	<b>-6.435</b>	<b>-6.438</b>	<b>-6.441</b>	<b>-250</b>
-390	-6.301	-6.306	-6.310	-6.315	-6.319	-6.323	-6.328	-6.332	-6.336	-6.340	-6.344	-240	-240	-6.344	-6.351	-6.358	-6.364	-6.370	-6.377	-6.382	-6.388	-6.393	-6.399	-6.404	-240
-380	-6.251	-6.257	-6.262	-6.267	-6.272	-6.277	-6.282	-6.287	-6.292	-6.296	-6.301	-230	-230	-6.262	-6.271	-6.280	-6.289	-6.297	-6.306	-6.314	-6.322	-6.329	-6.337	-6.344	-230
-370	-6.195	-6.201	-6.207	-6.213	-6.218	-6.224	-6.230	-6.235	-6.241	-6.246	-6.251	-220	-220	-6.158	-6.170	-6.181	-6.192	-6.202	-6.213	-6.223	-6.233	-6.243	-6.252	-6.262	-220
-360	-6.133	-6.139	-6.146	-6.152	-6.158	-6.165	-6.171	-6.177	-6.183	-6.189	-6.195	-210	-210	-6.035	-6.048	-6.061	-6.074	-6.087	-6.099	-6.111	-6.123	-6.135	-6.147	-6.158	-210
<b>-350</b>	<b>-6.064</b>	<b>-6.071</b>	<b>-6.078</b>	<b>-6.085</b>	<b>-6.092</b>	<b>-6.099</b>	<b>-6.106</b>	<b>-6.113</b>	<b>-6.119</b>	<b>-6.126</b>	<b>-6.133</b>	<b>-350</b>	<b>-200</b>	<b>-5.891</b>	<b>-5.907</b>	<b>-5.922</b>	<b>-5.936</b>	<b>-5.951</b>	<b>-5.965</b>	<b>-5.980</b>	<b>-5.994</b>	<b>-6.007</b>	<b>-6.021</b>	<b>-6.035</b>	<b>-200</b>
-340	-5.989	-5.997	-6.004	-6.012	-6.020	-6.027	-6.035	-6.042	-6.049	-6.057	-6.064	-190	-190	-5.730	-5.747	-5.763	-5.780	-5.797	-5.813	-5.829	-5.845	-5.861	-5.876	-5.891	-190
-330	-5.908	-5.917	-5.925	-5.933	-5.941	-5.949	-5.957	-5.965	-5.973	-5.981	-5.989	-180	-180	-5.550	-5.569	-5.588	-5.606	-5.624	-5.642	-5.660	-5.678	-5.695	-5.713	-5.730	-180
-320	-5.822	-5.831	-5.840	-5.848	-5.857	-5.866	-5.874	-5.883	-5.891	-5.900	-5.908	-170	-170	-5.354	-5.374	-5.395	-5.415	-5.435	-5.454	-5.474	-5.493	-5.512	-5.531	-5.550	-170
-310	-5.730	-5.739	-5.749	-5.758	-5.767	-5.776	-5.786	-5.795	-5.804	-5.813	-5.822	-160	-160	-5.141	-5.163	-5.185	-5.207	-5.228	-5.250	-5.271	-5.292	-5.313	-5.333	-5.354	-160
<b>-300</b>	<b>-5.632</b>	<b>-5.642</b>	<b>-5.652</b>	<b>-5.662</b>	<b>-5.672</b>	<b>-5.682</b>	<b>-5.691</b>	<b>-5.701</b>	<b>-5.711</b>	<b>-5.720</b>	<b>-5.730</b>	<b>-300</b>	<b>-180</b>	<b>-5.550</b>	<b>-5.569</b>	<b>-5.588</b>	<b>-5.606</b>	<b>-5.624</b>	<b>-5.642</b>	<b>-5.660</b>	<b>-5.678</b>	<b>-5.695</b>	<b>-5.713</b>	<b>-5.730</b>	<b>-180</b>
-290	-5.529	-5.540	-5.550	-5.561	-5.571	-5.581	-5.592	-5.602	-5.612	-5.622	-5.632	-290	-290	-5.354	-5.374	-5.395	-5.415	-5.435	-5.454	-5.474	-5.493	-5.512	-5.531	-5.550	-290
-280	-5.421	-5.432	-5.443	-5.454	-5.465	-5.476	-5.487	-5.497	-5.508	-5.519	-5.529	-280	-280	-5.141	-5.163	-5.185	-5.207	-5.228	-5.250	-5.271	-5.292	-5.313	-5.333	-5.354	-280
-270	-5.308	-5.320	-5.331	-5.343	-5.354	-5.365	-5.377	-5.388	-5.399	-5.410	-5.421	-270	-270	-4.913	-4.936	-4.960	-4.983	-5.006	-5.029	-5.052	-5.074	-5.097	-5.119	-5.141	-270
-260	-5.190	-5.202	-5.214	-5.226	-5.238	-5.250	-5.261	-5.273	-5.285	-5.296	-5.308	-260	-260	-4.669	-4.694	-4.719	-4.744	-4.768	-4.793	-4.817	-4.841	-4.865	-4.889	-4.913	-260
<b>-250</b>	<b>-5.067</b>	<b>-5.079</b>	<b>-5.092</b>	<b>-5.104</b>	<b>-5.117</b>	<b>-5.129</b>	<b>-5.141</b>	<b>-5.153</b>	<b>-5.166</b>	<b>-5.178</b>	<b>-5.190</b>	<b>-250</b>	<b>-150</b>	<b>-4.411</b>	<b>-4.437</b>	<b>-4.463</b>	<b>-4.490</b>	<b>-4.516</b>	<b>-4.542</b>	<b>-4.567</b>	<b>-4.593</b>	<b>-4.618</b>	<b>-4.644</b>	<b>-4.669</b>	<b>-150</b>
-240	-4.939	-4.952	-4.965	-4.978	-4.991	-5.003	-5.016	-5.029	-5.042	-5.054	-5.067	-240	-240	-4.138	-4.166	-4.194	-4.221	-4.249	-4.276	-4.303	-4.330	-4.357	-4.384	-4.411	-240
-230	-4.806	-4.820	-4.833	-4.847	-4.860	-4.873	-4.886	-4.900	-4.913	-4.926	-4.939	-230	-230	-3.852	-3.882	-3.911	-3.939	-3.968	-3.997	-4.025	-4.054	-4.082	-4.110	-4.138	-230
-220	-4.669	-4.683	-4.697	-4.711	-4.724	-4.738	-4.752	-4.766	-4.779	-4.793	-4.806	-220	-220	-3.554	-3.584	-3.614	-3.645	-3.675	-3.705	-3.734	-3.764	-3.794	-3.823	-3.852	-220
-210	-4.527	-4.542	-4.556	-4.570	-4.584	-4.599	-4.613	-4.627	-4.641	-4.655	-4.669	-210	-210	-3.243	-3.274	-3.306	-3.337	-3.368	-3.400	-3.431	-3.462	-3.492	-3.523	-3.554	-210
<b>-200</b>	<b>-4.381</b>	<b>-4.396</b>	<b>-4.411</b>	<b>-4.425</b>	<b>-4.440</b>	<b>-4.455</b>	<b>-4.469</b>	<b>-4.484</b>	<b>-4.498</b>	<b>-4.513</b>	<b>-4.527</b>	<b>-200</b>	<b>-110</b>	<b>-3.852</b>	<b>-3.882</b>	<b>-3.911</b>	<b>-3.939</b>	<b>-3.968</b>	<b>-3.997</b>	<b>-4.025</b>	<b>-4.054</b>	<b>-4.082</b>	<b>-4.110</b>	<b>-4.138</b>	<b>-110</b>
-190	-4.231	-4.246	-4.261	-4.276	-4.291	-4.306	-4.321	-4.336	-4.351	-4.366	-4.381	-190	-190	-3.554	-3.584	-3.614	-3.645	-3.675	-3.705	-3.734	-3.764	-3.794	-3.823	-3.852	-190
-180	-4.076	-4.091	-4.107	-4.123	-4.138	-4.154	-4.169	-4.185	-4.200	-4.215	-4.231	-180	-180	-3.243	-3.274	-3.306	-3.337	-3.368	-3.400	-3.431	-3.462	-3.492	-3.523	-3.554	-180
-170	-3.917	-3.933	-3.949	-3.965	-3.981	-3.997	-4.013	-4.029	-4.044	-4.060	-4.076	-170	-170	-2.920	-2.953	-2.986	-3.018	-3.050	-3.083	-3.115	-3.147	-3.179	-3.211	-3.243	-170
-160	-3.754	-3.771	-3.787	-3.803	-3.820	-3.836	-3.852	-3.869	-3.885	-3.901	-3.917	-160	-160	-2.587	-2.620	-2.654	-2.688	-2.721	-2.755	-2.788	-2.821	-2.854	-2.887	-2.920	-160
<b>-150</b>	<b>-3.587</b>	<b>-3.604</b>	<b>-3.621</b>	<b>-3.638</b>	<b>-3.655</b>	<b>-3.671</b>	<b>-3.688</b>	<b>-3.705</b>	<b>-3.721</b>	<b>-3.738</b>	<b>-3.754</b>	<b>-150</b>	<b>-100</b>	<b>-3.554</b>	<b>-3.584</b>	<b>-3.614</b>	<b>-3.645</b>	<b>-3.675</b>	<b>-3.705</b>	<b>-3.734</b>	<b>-3.764</b>	<b>-3.794</b>	<b>-3.823</b>	<b>-3.852</b>	<b>-100</b>
-140	-3.417	-3.434	-3.451	-3.468	-3.486	-3.503	-3.520	-3.537	-3.554	-3.571	-3.587	-140	-140	-3.243	-3.274	-3.306	-3.337	-3.368	-3.400	-3.431	-3.462	-3.492	-3.523	-3.554	-140
-130	-3.243	-3.260	-3.278	-3.295	-3.313	-3.330	-3.348	-3.366	-3.382	-3.400	-3.417	-130	-130	-2.920	-2.953	-2.986	-3.018	-3.050	-3.083	-3.115	-3.147	-3.179	-3.211	-3.243	-130
-120	-3.065	-3.083	-3.101	-3.119	-3.136	-3.154	-3.172	-3.190	-3.207	-3.225	-3.243	-120	-120	-2.587	-2.620	-2.654	-2.688	-2.721	-2.755	-2.788	-2.821	-2.854	-2.887	-2.920	-120
-110	-2.884	-2.902	-2.920	-2.938	-2.957	-2.975	-2.993	-3.011	-3.029	-3.047	-3.065	-110	-110	-2.243	-2.278	-2.312	-2.347	-2.382	-2.416	-2.450	-2.485	-2.519	-2.553	-2.587	-110
<b>-100</b>	<b>-2.699</b>	<b>-2.718</b>	<b>-2.736</b>	<b>-2.755</b>	<b>-2.773</b>	<b>-2.792</b>	<b>-2.810</b>	<b>-2.829</b>	<b>-2.847</b>	<b>-2.865</b>	<b>-2.884</b>	<b>-100</b>	<b>-90</b>	<b>-2.243</b>	<b>-2.278</b>	<b>-2.312</b>	<b>-2.347</b>	<b>-2.382</b>	<b>-2.416</b>	<b>-2.450</b>	<b>-2.485</b>	<b>-2.519</b>	<b>-2.553</b>	<b>-2.587</b>	<b>-90</b>
-90	-2.511	-2.530	-2.549	-2.568	-2.587	-2.605	-2.624	-2.643	-2.662	-2.680	-2.699	-90	-90	-1.889	-1.925	-1.961	-1.996	-2.032	-2.067	-2.103	-2.138	-2.173	-2.208	-2.243	-90
-80	-2.320	-2.339	-2.359	-2.378	-2.397	-2.416	-2.435	-2.454	-2.473	-2.492	-2.511	-80	-80	-1.527	-1.564	-1.600	-1.637	-1.673	-1.709	-1.745	-1.782	-1.818	-1.854	-1.889	-80
-70	-2.126	-2.146	-2.165	-2.185	-2.204	-2.223	-2.243	-2.262	-2.282	-2.301	-2.320	-70	-70	-1.156	-1.194	-1.231	-1.268	-1.305	-1.343	-1.380	-1.417	-1.453	-1.490	-1.527	-70
-60	-1.929	-1.949	-1.969	-1.988	-2.008	-2.028	-2.048	-2.067	-2.087	-2.106	-2.126	-60	-60	-0.778	-0.816	-0.854	-0.892	-0.930	-0.968	-1.006	-1.043	-1.081	-1.119	-1.156	-60
<b>-50</b>	<b>-1.729</b>	<b>-1.749</b>	<b>-1.770</b>	<b>-1.790</b>	<b>-1.810</b>	<b>-1.830</b>	<b>-1.850</b>	<b>-1.869</b>	<b>-1.889</b>	<b>-1.909</b>	<b>-1.929</b>	<b>-50</b>	<b>-30</b>	<b>-1.156</b>	<b>-1.194</b>	<b>-1.231</b>	<b>-1.268</b>	<b>-1.305</b>	<b>-1.343</b>	<b>-1.380</b>	<b>-1.417</b>	<b>-1.453</b>	<b>-1.490</b>	<b>-1.527</b>	<b>-30</b>
-40	-1.527	-1.547	-1.568	-1.588	-1.608	-1.628	-1.649	-1.669	-1.689	-1.709	-1.729	-40	-40	-0.778	-0.816	-0.854	-0.892	-0.930	-0.968	-1.006	-1.043	-1.081	-1.119	-1.156	-40
-30	-1.322	-1.343	-1.363	-1.384	-1.404	-1.425	-1.445	-1.466	-1.486	-1.507	-1.527	-30	-30	-0.392	-0.431	-0.470	-0.508	-0.547	-0.586	-0.624	-0.663	-0.701	-0.739	-0.778	-30
-20	-1.114	-1.135	-1.156	-1.177	-1.198	-1.218	-1.239	-1.260	-1.281	-1.301	-1.322	-20	-20												
-10	-0.905	-0.926	-0.947	-0.968	-0.989	-1.010	-1.031	-1.052	-1.07																

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50 °F - 550 °F

# Type K - Chromel vs Alumel

1 °C - 300 °C

°F	0	1	2	3	4	5	6	7	8	9	10	°F	°C	0	1	2	3	4	5	6	7	8	9	10	°C
EMF in Millivolts — Reference Junction 32°F												EMF in Millivolts — Reference Junctions 0 °C													
50	0.397	0.419	0.441	0.463	0.486	0.508	0.530	0.552	0.575	0.597	0.619	50	0	0.000	0.039	0.079	0.119	0.158	0.198	0.238	0.277	0.317	0.357	0.397	0
60	0.619	0.642	0.664	0.686	0.709	0.731	0.753	0.776	0.798	0.821	0.843	60	10	0.397	0.437	0.477	0.517	0.557	0.597	0.637	0.677	0.718	0.758	0.798	10
70	0.843	0.865	0.888	0.910	0.933	0.955	0.978	1.000	1.023	1.045	1.068	70	20	0.798	0.838	0.879	0.919	0.960	1.000	1.041	1.081	1.122	1.163	1.203	20
80	1.068	1.090	1.113	1.136	1.158	1.181	1.203	1.226	1.249	1.271	1.294	80	30	1.203	1.244	1.285	1.326	1.366	1.407	1.448	1.489	1.530	1.571	1.612	30
90	1.294	1.316	1.339	1.362	1.384	1.407	1.430	1.453	1.475	1.498	1.521	90	40	1.612	1.653	1.694	1.735	1.776	1.817	1.858	1.899	1.941	1.982	2.023	40
100	1.521	1.543	1.566	1.589	1.612	1.635	1.657	1.680	1.703	1.726	1.749	100	50	2.023	2.064	2.106	2.147	2.188	2.230	2.271	2.312	2.354	2.395	2.436	50
110	1.749	1.771	1.794	1.817	1.840	1.863	1.886	1.909	1.931	1.954	1.977	110	60	2.436	2.478	2.519	2.561	2.602	2.644	2.685	2.727	2.768	2.810	2.851	60
120	1.977	2.000	2.023	2.046	2.069	2.092	2.115	2.138	2.161	2.184	2.207	120	70	2.851	2.893	2.934	2.976	3.017	3.059	3.100	3.142	3.184	3.225	3.267	70
130	2.207	2.230	2.253	2.276	2.298	2.321	2.344	2.367	2.390	2.413	2.436	130	80	3.267	3.308	3.350	3.391	3.433	3.474	3.516	3.557	3.599	3.640	3.682	80
140	2.436	2.459	2.483	2.506	2.529	2.552	2.575	2.598	2.621	2.644	2.667	140	90	3.682	3.723	3.765	3.806	3.848	3.889	3.931	3.972	4.013	4.055	4.096	90
150	2.667	2.690	2.713	2.736	2.759	2.782	2.805	2.828	2.851	2.874	2.897	150	100	4.096	4.138	4.179	4.220	4.262	4.303	4.344	4.385	4.427	4.468	4.509	100
160	2.897	2.920	2.944	2.967	2.990	3.013	3.036	3.059	3.082	3.105	3.128	160	110	4.509	4.550	4.591	4.633	4.674	4.715	4.756	4.797	4.838	4.879	4.920	110
170	3.128	3.151	3.174	3.197	3.220	3.244	3.267	3.290	3.313	3.336	3.359	170	120	4.920	4.961	5.002	5.043	5.084	5.124	5.165	5.206	5.247	5.288	5.328	120
180	3.359	3.382	3.405	3.428	3.451	3.474	3.497	3.520	3.544	3.567	3.590	180	130	5.328	5.369	5.410	5.450	5.491	5.532	5.572	5.613	5.653	5.694	5.735	130
190	3.590	3.613	3.636	3.659	3.682	3.705	3.728	3.751	3.774	3.797	3.820	190	140	5.735	5.775	5.815	5.856	5.896	5.937	5.977	6.017	6.058	6.098	6.138	140
200	3.820	3.843	3.866	3.889	3.912	3.935	3.958	3.981	4.004	4.027	4.050	200	150	6.138	6.179	6.219	6.259	6.299	6.339	6.380	6.420	6.460	6.500	6.540	150
210	4.050	4.073	4.096	4.119	4.142	4.165	4.188	4.211	4.234	4.257	4.280	210	160	6.540	6.580	6.620	6.660	6.701	6.741	6.781	6.821	6.861	6.901	6.941	160
220	4.280	4.303	4.326	4.349	4.372	4.395	4.417	4.440	4.463	4.486	4.509	220	170	6.941	6.981	7.021	7.060	7.100	7.140	7.180	7.220	7.260	7.300	7.340	170
230	4.509	4.532	4.555	4.578	4.601	4.623	4.646	4.669	4.692	4.715	4.738	230	180	7.340	7.380	7.420	7.460	7.500	7.540	7.579	7.619	7.659	7.699	7.739	180
240	4.738	4.760	4.783	4.806	4.829	4.852	4.874	4.897	4.920	4.943	4.965	240	190	7.739	7.779	7.819	7.859	7.899	7.939	7.979	8.019	8.059	8.099	8.138	190
250	4.965	4.988	5.011	5.034	5.056	5.079	5.102	5.124	5.147	5.170	5.192	250	200	8.138	8.178	8.218	8.258	8.298	8.338	8.378	8.418	8.458	8.499	8.539	200
260	5.192	5.215	5.238	5.260	5.283	5.306	5.328	5.351	5.374	5.396	5.419	260	210	8.539	8.579	8.619	8.659	8.699	8.739	8.779	8.819	8.860	8.900	8.940	210
270	5.419	5.441	5.464	5.487	5.509	5.532	5.554	5.577	5.599	5.622	5.644	270	220	8.940	8.980	9.020	9.061	9.101	9.141	9.181	9.222	9.262	9.302	9.343	220
280	5.644	5.667	5.690	5.712	5.735	5.757	5.779	5.802	5.824	5.847	5.869	280	230	9.343	9.383	9.423	9.464	9.504	9.545	9.585	9.626	9.666	9.707	9.747	230
290	5.869	5.892	5.914	5.937	5.959	5.982	6.004	6.026	6.049	6.071	6.094	290	240	9.747	9.788	9.828	9.869	9.909	9.950	9.991	10.031	10.072	10.113	10.153	240
300	6.094	6.116	6.138	6.161	6.183	6.205	6.228	6.250	6.272	6.295	6.317	300	250	10.153	10.194	10.235	10.276	10.316	10.357	10.398	10.439	10.480	10.520	10.561	250
310	6.317	6.339	6.362	6.384	6.406	6.429	6.451	6.473	6.496	6.518	6.540	310	260	10.561	10.602	10.643	10.684	10.725	10.766	10.807	10.848	10.889	10.930	10.971	260
320	6.540	6.562	6.585	6.607	6.629	6.652	6.674	6.696	6.718	6.741	6.763	320	270	10.971	11.012	11.053	11.094	11.135	11.176	11.217	11.259	11.300	11.341	11.382	270
330	6.763	6.785	6.807	6.829	6.852	6.874	6.896	6.918	6.941	6.963	6.985	330	280	11.382	11.423	11.465	11.506	11.547	11.588	11.630	11.671	11.712	11.753	11.795	280
340	6.985	7.007	7.029	7.052	7.074	7.096	7.118	7.140	7.163	7.185	7.207	340	290	11.795	11.836	11.877	11.919	11.960	12.001	12.043	12.084	12.126	12.167	12.209	290
350	7.207	7.229	7.251	7.273	7.296	7.318	7.340	7.362	7.384	7.407	7.429	350	300												
360	7.429	7.451	7.473	7.495	7.517	7.540	7.562	7.584	7.606	7.628	7.650	360	310												
370	7.650	7.673	7.695	7.717	7.739	7.761	7.783	7.806	7.828	7.850	7.872	370	320												
380	7.872	7.894	7.917	7.939	7.961	7.983	8.005	8.027	8.050	8.072	8.094	380	330												
390	8.094	8.116	8.138	8.161	8.183	8.205	8.227	8.250	8.272	8.294	8.316	390	340												
400	8.316	8.338	8.361	8.383	8.405	8.427	8.450	8.472	8.494	8.516	8.539	400	350												
410	8.539	8.561	8.583	8.605	8.628	8.650	8.672	8.694	8.717	8.739	8.761	410	360												
420	8.761	8.784	8.806	8.828	8.851	8.873	8.895	8.918	8.940	8.962	8.985	420	370												
430	8.985	9.007	9.029	9.052	9.074	9.096	9.119	9.141	9.163	9.186	9.208	430	380												
440	9.208	9.231	9.253	9.275	9.298	9.320	9.343	9.365	9.388	9.410	9.432	440	390												
450	9.432	9.455	9.477	9.500	9.522	9.545	9.567	9.590	9.612	9.635	9.657	450	400												
460	9.657	9.680	9.702	9.725	9.747	9.770	9.792	9.815	9.837	9.860	9.882	460	410												
470	9.882	9.905	9.927	9.950	9.973	9.995	10.018	10.040	10.063	10.086	10.108	470	420												
480	10.108	10.131	10.153	10.176	10.199	10.221	10.244	10.267	10.289	10.312	10.334	480	430												
490	10.334	10.357	10.380	10.402	10.425	10.448	10.471	10.493	10.516	10.539	10.561	490	440												
500	10.561	10.584	10.607	10.629	10.652	10.675	10.698	10.720	10.743	10.766	10.789	500	450												
510	10.789	10.811	10.834	10.857	10.880	10.903	10.925	10.948	10.971	10.994	11.017	510	460												
520	11.017	11.039	11.062	11.085	11.108	11.131	11.154	11.177	11.199	11.222	11.245	520	470												
530	11.245	11.268	11.291	11.313	11.336	11.359	11.382	11.405	11.428	11.451	11.474	530	480												
540	11.474	11.497	11.519	11.542	11.565	11.588	11.611	11.634	11.657	11.680	11.703	540	490												

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°F	0	1	2	3	4	5	6	7	8	9	10	°F	°C	0	1	2	3	4	5	6	7	8	9	10	°C
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°F												°C													
0	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9	10				
EMF in Millivolts — Reference Junction 32°F												EMF in Millivolts — Reference Junctions 0 °C													
550	11.703	11.726	11.749	11.772	11.795	11.818	11.841	11.864	11.887	11.910	11.933	550	300	12.209	12.250	12.291	12.333	12.374	12.416	12.457	12.499	12.540	12.582	12.624	300
560	11.933	11.956	11.978	12.001	12.024	12.047	12.070	12.093	12.116	12.140	12.163	560	310	12.624	12.665	12.707	12.748	12.790	12.831	12.873	12.915	12.956	12.998	13.040	310
570	12.163	12.186	12.209	12.232	12.255	12.278	12.301	12.324	12.347	12.370	12.393	570	320	13.040	13.081	13.123	13.165	13.206	13.248	13.290	13.331	13.373	13.415	13.457	320
580	12.393	12.416	12.439	12.462	12.485	12.508	12.531	12.554	12.577	12.600	12.624	580	330	13.457	13.498	13.540	13.582	13.624	13.665	13.707	13.749	13.791	13.833	13.874	330
590	12.624	12.647	12.670	12.693	12.716	12.739	12.762	12.785	12.808	12.831	12.855	590	340	13.874	13.916	13.958	14.000	14.042	14.084	14.126	14.167	14.209	14.251	14.293	340
600	12.855	12.878	12.901	12.924	12.947	12.970	12.993	13.016	13.040	13.063	13.086	600	350	14.293	14.335	14.377	14.419	14.461	14.503	14.545	14.587	14.629	14.671	14.713	350
610	13.086	13.109	13.132	13.155	13.179	13.202	13.225	13.248	13.271	13.294	13.318	610	360	14.713	14.755	14.797	14.839	14.881	14.923	14.965	15.007	15.049	15.091	15.133	360
620	13.318	13.341	13.364	13.387	13.410	13.433	13.457	13.480	13.503	13.526	13.549	620	370	15.133	15.175	15.217	15.259	15.301	15.343	15.385	15.427	15.469	15.511	15.554	370
630	13.549	13.573	13.596	13.619	13.642	13.665	13.689	13.712	13.735	13.758	13.782	630	380	15.554	15.596	15.638	15.680	15.722	15.764	15.806	15.849	15.891	15.933	15.975	380
640	13.782	13.805	13.828	13.851	13.874	13.898	13.921	13.944	13.967	13.991	14.014	640	390	15.975	16.017	16.059	16.102	16.144	16.186	16.228	16.270	16.313	16.355	16.397	390
650	14.014	14.037	14.060	14.084	14.107	14.130	14.154	14.177	14.200	14.223	14.247	650	400	16.397	16.439	16.482	16.524	16.566	16.608	16.651	16.693	16.735	16.778	16.820	400
660	14.247	14.270	14.293	14.316	14.340	14.363	14.386	14.410	14.433	14.456	14.479	660	410	16.820	16.862	16.904	16.947	16.989	17.031	17.074	17.116	17.158	17.201	17.243	410
670	14.479	14.503	14.526	14.549	14.573	14.596	14.619	14.643	14.666	14.689	14.713	670	420	17.243	17.285	17.328	17.370	17.413	17.455	17.497	17.540	17.582	17.624	17.667	420
680	14.713	14.736	14.759	14.783	14.806	14.829	14.853	14.876	14.899	14.923	14.946	680	430	17.667	17.709	17.752	17.794	17.837	17.879	17.921	17.964	18.006	18.049	18.091	430
690	14.946	14.969	14.993	15.016	15.039	15.063	15.086	15.109	15.133	15.156	15.179	690	440	18.091	18.134	18.176	18.218	18.261	18.303	18.346	18.388	18.431	18.473	18.516	440
700	15.179	15.203	15.226	15.250	15.273	15.296	15.320	15.343	15.366	15.390	15.413	700	450	18.516	18.558	18.601	18.643	18.686	18.728	18.771	18.813	18.856	18.898	18.941	450
710	15.413	15.437	15.460	15.483	15.507	15.530	15.554	15.577	15.600	15.624	15.647	710	460	18.941	18.983	19.026	19.068	19.111	19.154	19.196	19.239	19.281	19.324	19.366	460
720	15.647	15.671	15.694	15.717	15.741	15.764	15.788	15.811	15.834	15.858	15.881	720	470	19.366	19.409	19.451	19.494	19.537	19.579	19.622	19.664	19.707	19.750	19.792	470
730	15.881	15.905	15.928	15.952	15.975	15.998	16.022	16.045	16.069	16.092	16.116	730	480	19.792	19.835	19.877	19.920	19.962	20.005	20.048	20.090	20.133	20.175	20.218	480
740	16.116	16.139	16.163	16.186	16.209	16.233	16.256	16.280	16.303	16.327	16.350	740	490	20.218	20.261	20.303	20.346	20.389	20.431	20.474	20.516	20.559	20.602	20.644	490
750	16.350	16.374	16.397	16.421	16.444	16.468	16.491	16.515	16.538	16.561	16.585	750	500	20.644	20.687	20.730	20.772	20.815	20.857	20.900	20.943	20.985	21.028	21.071	500
760	16.585	16.608	16.632	16.655	16.679	16.702	16.726	16.749	16.773	16.796	16.820	760	510	21.071	21.113	21.156	21.199	21.241	21.284	21.326	21.369	21.412	21.454	21.497	510
770	16.820	16.843	16.867	16.890	16.914	16.937	16.961	16.984	17.008	17.031	17.055	770	520	21.497	21.540	21.582	21.625	21.668	21.710	21.753	21.796	21.838	21.881	21.924	520
780	17.055	17.078	17.102	17.125	17.149	17.173	17.196	17.220	17.243	17.267	17.290	780	530	21.924	21.966	22.009	22.052	22.094	22.137	22.179	22.222	22.265	22.307	22.350	530
790	17.290	17.314	17.337	17.361	17.384	17.408	17.431	17.455	17.478	17.502	17.526	790	540	22.350	22.393	22.435	22.478	22.521	22.563	22.606	22.649	22.691	22.734	22.776	540
800	17.526	17.549	17.573	17.596	17.620	17.643	17.667	17.690	17.714	17.738	17.761	800	550	22.776	22.819	22.862	22.904	22.947	22.990	23.032	23.075	23.117	23.160	23.203	550
810	17.761	17.785	17.808	17.832	17.855	17.879	17.902	17.926	17.950	17.973	17.997	810	560	23.203	23.245	23.288	23.331	23.373	23.416	23.458	23.501	23.544	23.586	23.629	560
820	17.997	18.020	18.044	18.068	18.091	18.115	18.138	18.162	18.185	18.209	18.233	820	570	23.629	23.671	23.714	23.757	23.799	23.842	23.884	23.927	23.970	24.012	24.055	570
830	18.233	18.256	18.280	18.303	18.327	18.351	18.374	18.398	18.421	18.445	18.469	830	580	24.055	24.097	24.140	24.182	24.225	24.267	24.310	24.353	24.395	24.438	24.480	580
840	18.469	18.492	18.516	18.539	18.563	18.587	18.610	18.634	18.657	18.681	18.705	840	590	24.480	24.523	24.565	24.608	24.650	24.693	24.735	24.778	24.820	24.863	24.905	590
850	18.705	18.728	18.752	18.776	18.799	18.823	18.846	18.870	18.894	18.917	18.941	850													
860	18.941	18.965	18.988	19.012	19.035	19.059	19.083	19.106	19.130	19.154	19.177	860													
870	19.177	19.201	19.224	19.248	19.272	19.295	19.319	19.343	19.366	19.390	19.414	870													
880	19.414	19.437	19.461	19.485	19.508	19.532	19.556	19.579	19.603	19.626	19.650	880													
890	19.650	19.674	19.697	19.721	19.745	19.768	19.792	19.816	19.839	19.863	19.887	890													
900	19.887	19.910	19.934	19.958	19.981	20.005	20.029	20.052	20.076	20.100	20.123	900													
910	20.123	20.147	20.171	20.194	20.218	20.242	20.265	20.289	20.313	20.336	20.360	910													
920	20.360	20.384	20.407	20.431	20.455	20.479	20.502	20.526	20.550	20.573	20.597	920													
930	20.597	20.621	20.644	20.668	20.692	20.715	20.739	20.763	20.786	20.810	20.834	930													
940	20.834	20.857	20.881	20.905	20.929	20.952	20.976	21.000	21.023	21.047	21.071	940													
950	21.071	21.094	21.118	21.142	21.165	21.189	21.213	21.236	21.260	21.284	21.308	950													
960	21.308	21.331	21.355	21.379	21.402	21.426	21.450	21.473	21.497	21.521	21.544	960													
970	21.544	21.568	21.592	21.616	21.639	21.663	21.687	21.710	21.734	21.758	21.781	970													
980	21.781	21.805	21.829	21.852	21.876	21.900	21.924	21.947	21.971	21.995	22.018	980													
990	22.018	22.042	22.066	22.089	22.113	22.137	22.160	22.184	22.208	22.232	22.255	990													
1000	22.255	22.279	22.303	22.326	22.350	22.374	22.397	22.421	22.445	22.468	22.492	1000													
1010	22.492	22.516	22.540	22.563	22.587	22.611	22.634	22.658	22.682	22.705	22.729	1010													
1020	22.729	22.753	22.776	22.800	22.824	22.847	22.871	22.895	22.919</																













550 °F - 750 °F

Type T - Copper vs Constantan

350 °C - 400 °C

°F											°C														
0	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9	10				
EMF in Millivolts — Reference Junction 32°F											EMF in Millivolts — Reference Junctions 0 °C														
550	14.155	14.187	14.219	14.251	14.283	14.315	14.347	14.379	14.411	14.444	14.476	550	350	17.819	17.879	17.939	17.999	18.060	18.120	18.180	18.241	18.301	18.362	18.422	350
560	14.476	14.508	14.540	14.572	14.604	14.636	14.669	14.701	14.733	14.765	14.797	560	360	18.422	18.483	18.543	18.604	18.665	18.725	18.786	18.847	18.908	18.969	19.030	360
570	14.797	14.830	14.862	14.894	14.926	14.959	14.991	15.023	15.056	15.088	15.121	570	370	19.030	19.091	19.152	19.213	19.274	19.335	19.396	19.457	19.518	19.579	19.641	370
580	15.121	15.153	15.185	15.218	15.250	15.283	15.315	15.347	15.380	15.412	15.445	580	380	19.641	19.702	19.763	19.825	19.886	19.947	20.009	20.070	20.132	20.193	20.255	380
590	15.445	15.477	15.510	15.543	15.575	15.608	15.640	15.673	15.705	15.738	15.771	590	390	20.255	20.317	20.378	20.440	20.502	20.563	20.625	20.687	20.748	20.810	20.872	390
600	15.771	15.803	15.836	15.869	15.901	15.934	15.967	15.999	16.032	16.065	16.098	600	400	20.872											400
610	16.098	16.130	16.163	16.196	16.229	16.262	16.295	16.327	16.360	16.393	16.426														
620	16.426	16.459	16.492	16.525	16.558	16.591	16.624	16.657	16.690	16.723	16.756														
630	16.756	16.789	16.822	16.855	16.888	16.921	16.954	16.987	17.020	17.053	17.086														
640	17.086	17.120	17.153	17.186	17.219	17.252	17.286	17.319	17.352	17.385	17.418														
650	17.418	17.452	17.485	17.518	17.552	17.585	17.618	17.652	17.685	17.718	17.752														
660	17.752	17.785	17.819	17.852	17.886	17.919	17.952	17.986	18.019	18.053	18.086														
670	18.086	18.120	18.154	18.187	18.221	18.254	18.288	18.321	18.355	18.389	18.422														
680	18.422	18.456	18.490	18.523	18.557	18.591	18.624	18.658	18.692	18.725	18.759														
690	18.759	18.793	18.827	18.861	18.894	18.928	18.962	18.996	19.030	19.064	19.097														
700	19.097	19.131	19.165	19.199	19.233	19.267	19.301	19.335	19.369	19.403	19.437														
710	19.437	19.471	19.505	19.539	19.573	19.607	19.641	19.675	19.709	19.743	19.777														
720	19.777	19.811	19.845	19.879	19.913	19.947	19.982	20.016	20.050	20.084	20.118														
730	20.118	20.152	20.187	20.221	20.255	20.289	20.323	20.358	20.392	20.426	20.460														
740	20.460	20.495	20.529	20.563	20.597	20.632	20.666	20.700	20.735	20.769	20.803														
750	20.803	20.838	20.872																						

T







°F											°F											°C											°C										
EMF in Millivolts — Reference Junction 32°F											EMF in Millivolts — Reference Junctions 0 °C																																
0	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9	10
550	20.086	20.129	20.172	20.216	20.259	20.302	20.345	20.388	20.431	20.474	20.517	550	300	21.036	21.114	21.192	21.270	21.348	21.426	21.504	21.582	21.660	21.739	21.817	300	21.036	21.114	21.192	21.270	21.348	21.426	21.504	21.582	21.660	21.739	21.817							
560	20.517	20.561	20.604	20.647	20.690	20.733	20.777	20.820	20.863	20.906	20.950	560	310	21.817	21.895	21.973	22.051	22.130	22.208	22.286	22.365	22.443	22.522	22.600	310	21.817	21.895	21.973	22.051	22.130	22.208	22.286	22.365	22.443	22.522	22.600							
570	20.950	20.993	21.036	21.080	21.123	21.166	21.209	21.253	21.296	21.339	21.383	570	320	22.600	22.678	22.757	22.835	22.914	22.993	23.071	23.150	23.228	23.307	23.386	320	22.600	22.678	22.757	22.835	22.914	22.993	23.071	23.150	23.228	23.307	23.386							
580	21.383	21.426	21.470	21.513	21.556	21.600	21.643	21.686	21.730	21.773	21.817	580	330	23.386	23.464	23.543	23.622	23.701	23.780	23.858	23.937	24.016	24.095	24.174	330	23.386	23.464	23.543	23.622	23.701	23.780	23.858	23.937	24.016	24.095	24.174							
590	21.817	21.860	21.904	21.947	21.991	22.034	22.078	22.121	22.165	22.208	22.252	590	340	24.174	24.253	24.332	24.411	24.490	24.569	24.648	24.727	24.806	24.885	24.964	340	24.174	24.253	24.332	24.411	24.490	24.569	24.648	24.727	24.806	24.885	24.964							
600	22.252	22.295	22.339	22.382	22.426	22.469	22.513	22.556	22.600	22.644	22.687	600	350	24.964	25.044	25.123	25.202	25.281	25.360	25.440	25.519	25.598	25.678	25.757	350	24.964	25.044	25.123	25.202	25.281	25.360	25.440	25.519	25.598	25.678	25.757							
610	22.687	22.731	22.774	22.818	22.862	22.905	22.949	22.993	23.036	23.080	23.124	610	360	25.757	25.836	25.916	25.995	26.075	26.154	26.233	26.313	26.392	26.472	26.552	360	25.757	25.836	25.916	25.995	26.075	26.154	26.233	26.313	26.392	26.472	26.552							
620	23.124	23.167	23.211	23.255	23.298	23.342	23.386	23.429	23.473	23.517	23.561	620	370	26.552	26.631	26.711	26.790	26.870	26.950	27.029	27.109	27.189	27.268	27.348	370	26.552	26.631	26.711	26.790	26.870	26.950	27.029	27.109	27.189	27.268	27.348							
630	23.561	23.604	23.648	23.692	23.736	23.780	23.823	23.867	23.911	23.955	23.999	630	380	27.348	27.428	27.507	27.587	27.667	27.747	27.827	27.907	27.986	28.066	28.146	380	27.348	27.428	27.507	27.587	27.667	27.747	27.827	27.907	27.986	28.066	28.146							
640	23.999	24.042	24.086	24.130	24.174	24.218	24.262	24.305	24.349	24.393	24.437	640	390	28.146	28.226	28.306	28.386	28.466	28.546	28.626	28.706	28.786	28.866	28.946	390	28.146	28.226	28.306	28.386	28.466	28.546	28.626	28.706	28.786	28.866	28.946							
650	24.437	24.481	24.525	24.569	24.613	24.657	24.701	24.745	24.789	24.833	24.876	650	400	28.946	29.026	29.106	29.186	29.266	29.346	29.427	29.507	29.587	29.667	29.747	400	28.946	29.026	29.106	29.186	29.266	29.346	29.427	29.507	29.587	29.667	29.747							
660	24.876	24.920	24.964	25.008	25.052	25.096	25.140	25.184	25.228	25.272	25.316	660	410	29.747	29.827	29.908	29.988	30.068	30.148	30.229	30.309	30.389	30.470	30.550	410	29.747	29.827	29.908	29.988	30.068	30.148	30.229	30.309	30.389	30.470	30.550							
670	25.316	25.360	25.404	25.448	25.493	25.537	25.581	25.625	25.669	25.713	25.757	670	420	30.550	30.630	30.711	30.791	30.871	30.952	31.032	31.112	31.193	31.273	31.354	420	30.550	30.630	30.711	30.791	30.871	30.952	31.032	31.112	31.193	31.273	31.354							
680	25.757	25.801	25.845	25.889	25.933	25.977	26.022	26.066	26.110	26.154	26.198	680	430	31.354	31.434	31.515	31.595	31.676	31.756	31.837	31.917	31.998	32.078	32.159	430	31.354	31.434	31.515	31.595	31.676	31.756	31.837	31.917	31.998	32.078	32.159							
690	26.198	26.242	26.286	26.331	26.375	26.419	26.463	26.507	26.552	26.596	26.640	690	440	32.159	32.239	32.320	32.400	32.481	32.562	32.642	32.723	32.803	32.884	32.965	440	32.159	32.239	32.320	32.400	32.481	32.562	32.642	32.723	32.803	32.884	32.965							
700	26.640	26.684	26.728	26.773	26.817	26.861	26.905	26.950	26.994	27.038	27.082	700	450	32.965	33.045	33.126	33.207	33.287	33.368	33.449	33.529	33.610	33.691	33.772	450	32.965	33.045	33.126	33.207	33.287	33.368	33.449	33.529	33.610	33.691	33.772							
710	27.082	27.127	27.171	27.215	27.259	27.304	27.348	27.392	27.437	27.481	27.525	710	460	33.772	33.852	33.933	34.014	34.095	34.175	34.256	34.337	34.418	34.498	34.579	460	33.772	33.852	33.933	34.014	34.095	34.175	34.256	34.337	34.418	34.498	34.579							
720	27.525	27.570	27.614	27.658	27.703	27.747	27.791	27.836	27.880	27.924	27.969	720	470	34.579	34.660	34.741	34.822	34.902	34.983	35.064	35.145	35.226	35.307	35.387	470	34.579	34.660	34.741	34.822	34.902	34.983	35.064	35.145	35.226	35.307	35.387							
730	27.969	28.013	28.057	28.102	28.146	28.191	28.235	28.279	28.324	28.368	28.413	730	480	35.387	35.468	35.549	35.630	35.711	35.792	35.873	35.954	36.034	36.115	36.196	480	35.387	35.468	35.549	35.630	35.711	35.792	35.873	35.954	36.034	36.115	36.196							
740	28.413	28.457	28.501	28.546	28.590	28.635	28.679	28.724	28.768	28.813	28.857	740	490	36.196	36.277	36.358	36.439	36.520	36.601	36.682	36.763	36.843	36.924	37.005	490	36.196	36.277	36.358	36.439	36.520	36.601	36.682	36.763	36.843	36.924	37.005							
750	28.857	28.901	28.946	28.990	29.035	29.079	29.124	29.168	29.213	29.257	29.302	750	500	37.005	37.086	37.167	37.248	37.329	37.410	37.491	37.572	37.653	37.734	37.815	500	37.005	37.086	37.167	37.248	37.329	37.410	37.491	37.572	37.653	37.734	37.815							
760	29.302	29.346	29.391	29.435	29.480	29.525	29.569	29.614	29.658	29.703	29.747	760	510	37.815	37.896	37.977	38.058	38.139	38.220	38.300	38.381	38.462	38.543	38.624	510	37.815	37.896	37.977	38.058	38.139	38.220	38.300	38.381	38.462	38.543	38.624							
770	29.747	29.792	29.836	29.881	29.925	29.970	30.015	30.059	30.104	30.148	30.193	770	520	38.624	38.705	38.786	38.867	38.948	39.029	39.110	39.191	39.272	39.353	39.434	520	38.624	38.705	38.786	38.867	38.948	39.029	39.110	39.191	39.272	39.353	39.434							
780	30.193	30.238	30.282	30.327	30.371	30.416	30.461	30.505	30.550	30.595	30.639	780	530	39.434	39.515	39.596	39.677	39.758	39.839	39.920	40.001	40.082	40.163	40.243	530	39.434	39.515	39.596	39.677	39.758	39.839	39.920	40.001	40.082	40.163	40.243							
790	30.639	30.684	30.728	30.773	30.818	30.862	30.907	30.952	30.996	31.041	31.086	790	540	40.243	40.324	40.405	40.486	40.567	40.648	40.729	40.810	40.891	40.972	41.053	540	40.243	40.324	40.405	40.486	40.567	40.648	40.729	40.810	40.891	40.972	41.053							
800	31.086	31.130	31.175	31.220	31.264	31.309	31.354	31.398	31.443	31.488	31.533	800	550	41.053	41.134	41.215	41.296	41.377	41.457	41.538	41.619	41.700	41.781	41.862	550	41.053	41.134	41.215	41.296	41.377	41.457	41.538	41.619	41.700	41.781	41.862							
810	31.533	31.577	31.622	31.667	31.711	31.756	31.801	31.846	31.890	31.935	31.980	810	560	41.862	41.943	42.024	42.105	42.185	42.266	42.347	42.428	42.509	42.590	42.671	560	41.862	41.943	42.024	42.105	42.185	42.266	42.347	42.428	42.509	42.590	42.671							
820	31.980	32.025	32.069	32.114	32.159	32.204	32.248	32.293	32.338	32.383	32.427	820	570	42.671	42.751	42.832	42.913	42.994	43.075	43.156	43.236	43.317	43.398	43.479	570	42.671	42.751	42.832	42.913	42.994	43.075	43.156	43.236	43.317	43.398	43.479							
830	32.427	32.472	32.517	32.562	32.606	32.651	32.696	32.741	32.786	32.830	32.875	830	580	43.479	43.560	43.640	43.721	43.802	43.883	43.963	44.044	44.125	44.206	44.286	580	43.479	43.560	43.640	43.721	43.802	43.883	43.963	44.044	44.125	44.206	44.286							
840	32.875	32.920	32.965	33.010	33.054	33.099	33.144	33.189	33.234	33.278	33.323	840	59																														



°F	0	1	2	3	4	5	6	7	8	9	10	°F	°C	0	1	2	3	4	5	6	7	8	9	10	°C
EMF in Millivolts — Reference Junction 32°F												EMF in Millivolts — Reference Junctions 0 °C													
1550	64.403	64.447	64.490	64.533	64.576	64.619	64.663	64.706	64.749	64.792	64.835	1550	900	68.787	68.863	68.940	69.017	69.094	69.171	69.247	69.324	69.401	69.477	69.554	900
1560	64.835	64.879	64.922	64.965	65.008	65.051	65.094	65.138	65.181	65.224	65.267	1560	910	69.554	69.631	69.707	69.784	69.860	69.937	70.013	70.090	70.166	70.243	70.319	910
1570	65.267	65.310	65.353	65.396	65.440	65.483	65.526	65.569	65.612	65.655	65.698	1570	920	70.319	70.396	70.472	70.548	70.625	70.701	70.777	70.854	70.930	71.006	71.082	920
1580	65.698	65.741	65.784	65.827	65.871	65.914	65.957	66.000	66.043	66.086	66.129	1580	930	71.082	71.159	71.235	71.311	71.387	71.463	71.539	71.615	71.692	71.768	71.844	930
1590	66.129	66.172	66.215	66.258	66.301	66.344	66.387	66.430	66.473	66.516	66.559	1590	940	71.844	71.920	71.996	72.072	72.147	72.223	72.299	72.375	72.451	72.527	72.603	940
1600	66.559	66.602	66.645	66.688	66.731	66.774	66.817	66.860	66.903	66.946	66.989	1600	950	72.603	72.678	72.754	72.830	72.906	72.981	73.057	73.133	73.208	73.284	73.360	950
1610	66.989	67.031	67.074	67.117	67.160	67.203	67.246	67.289	67.332	67.375	67.418	1610	960	73.360	73.435	73.511	73.586	73.662	73.738	73.813	73.889	73.964	74.040	74.115	960
1620	67.418	67.460	67.503	67.546	67.589	67.632	67.675	67.718	67.760	67.803	67.846	1620	970	74.115	74.190	74.266	74.341	74.417	74.492	74.567	74.643	74.718	74.793	74.869	970
1630	67.846	67.889	67.932	67.974	68.017	68.060	68.103	68.146	68.188	68.231	68.274	1630	980	74.869	74.944	75.019	75.095	75.170	75.245	75.320	75.395	75.471	75.546	75.621	980
1640	68.274	68.317	68.359	68.402	68.445	68.488	68.530	68.573	68.616	68.659	68.701	1640	990	75.621	75.696	75.771	75.847	75.922	75.997	76.072	76.147	76.223	76.298	76.373	990
1650	68.701	68.744	68.787	68.829	68.872	68.915	68.957	69.000	69.043	69.085	69.128	1650	1000	76.373											1000
1660	69.128	69.171	69.213	69.256	69.298	69.341	69.384	69.426	69.469	69.511	69.554														
1670	69.554	69.597	69.639	69.682	69.724	69.767	69.809	69.852	69.894	69.937	69.979														
1680	69.979	70.022	70.064	70.107	70.149	70.192	70.234	70.277	70.319	70.362	70.404														
1690	70.404	70.447	70.489	70.531	70.574	70.616	70.659	70.701	70.744	70.786	70.828														
1700	70.828	70.871	70.913	70.955	70.998	71.040	71.082	71.125	71.167	71.209	71.252														
1710	71.252	71.294	71.336	71.379	71.421	71.463	71.506	71.548	71.590	71.632	71.675														
1720	71.675	71.717	71.759	71.801	71.844	71.886	71.928	71.970	72.012	72.055	72.097														
1730	72.097	72.139	72.181	72.223	72.266	72.308	72.350	72.392	72.434	72.476	72.518														
1740	72.518	72.561	72.603	72.645	72.687	72.729	72.771	72.813	72.855	72.897	72.939														
1750	72.939	72.981	73.023	73.066	73.108	73.150	73.192	73.234	73.276	73.318	73.360														
1760	73.360	73.402	73.444	73.486	73.528	73.570	73.612	73.654	73.696	73.738	73.780														
1770	73.780	73.821	73.863	73.905	73.947	73.989	74.031	74.073	74.115	74.157	74.199														
1780	74.199	74.241	74.283	74.324	74.366	74.408	74.450	74.492	74.534	74.576	74.618														
1790	74.618	74.659	74.701	74.743	74.785	74.827	74.869	74.910	74.952	74.994	75.036														
1800	75.036	75.078	75.120	75.161	75.203	75.245	75.287	75.329	75.370	75.412	75.454														
1810	75.454	75.496	75.538	75.579	75.621	75.663	75.705	75.746	75.788	75.830	75.872														
1820	75.872	75.913	75.955	75.997	76.039	76.081	76.122	76.164	76.206	76.248	76.289														
1830	76.289	76.331	76.373																						

-454 °F - 50 °F

Type N - Nicrosil vs Nisil

270 °C - 50 °C

°F	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	°F	°C	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	°C		
	EMF in Millivolts — Reference Junction 32°F													EMF in Millivolts — Reference Junctions 0 °C													
-450	-4.344	-4.344	-4.345	-4.345	-4.345	-4.342	-4.342	-4.343	-4.343	-4.344	-4.344	-450	-270	-4.345												-270	
-440	-4.339	-4.340	-4.340	-4.341	-4.341	-4.342	-4.342	-4.343	-4.343	-4.344	-4.344	-440	-260	-4.336	-4.337	-4.339	-4.340	-4.341	-4.342	-4.343	-4.344	-4.344	-4.345	-4.345	-4.345	-4.345	-260
-430	-4.330	-4.331	-4.332	-4.333	-4.334	-4.335	-4.336	-4.337	-4.337	-4.338	-4.339	-430	-260	-4.336	-4.337	-4.339	-4.340	-4.341	-4.342	-4.343	-4.344	-4.344	-4.345	-4.345	-4.345	-260	
-420	-4.316	-4.318	-4.319	-4.321	-4.322	-4.324	-4.325	-4.326	-4.327	-4.329	-4.330	-420	-260	-4.316	-4.318	-4.319	-4.321	-4.322	-4.324	-4.325	-4.326	-4.327	-4.329	-4.330	-4.330	-420	
-410	-4.299	-4.301	-4.303	-4.305	-4.306	-4.308	-4.310	-4.312	-4.313	-4.315	-4.316	-410	-260	-4.299	-4.301	-4.303	-4.305	-4.306	-4.308	-4.310	-4.312	-4.313	-4.315	-4.316	-4.316	-410	
-400	-4.277	-4.279	-4.282	-4.284	-4.286	-4.288	-4.291	-4.293	-4.295	-4.297	-4.299	-400	-250	-4.313	-4.316	-4.319	-4.321	-4.324	-4.326	-4.328	-4.330	-4.332	-4.334	-4.336	-4.336	-250	
-390	-4.251	-4.254	-4.256	-4.259	-4.262	-4.264	-4.267	-4.270	-4.272	-4.275	-4.277	-390	-240	-4.277	-4.281	-4.285	-4.289	-4.293	-4.297	-4.300	-4.304	-4.307	-4.310	-4.313	-4.313	-240	
-380	-4.220	-4.223	-4.226	-4.230	-4.233	-4.236	-4.239	-4.242	-4.245	-4.248	-4.251	-380	-230	-4.226	-4.232	-4.238	-4.243	-4.248	-4.254	-4.258	-4.263	-4.268	-4.273	-4.277	-4.277	-230	
-370	-4.185	-4.189	-4.192	-4.196	-4.199	-4.203	-4.206	-4.210	-4.213	-4.217	-4.220	-370	-230	-4.226	-4.232	-4.238	-4.243	-4.248	-4.254	-4.258	-4.263	-4.268	-4.273	-4.277	-4.277	-230	
-360	-4.145	-4.150	-4.154	-4.158	-4.162	-4.166	-4.170	-4.174	-4.177	-4.181	-4.185	-360	-220	-4.162	-4.169	-4.176	-4.183	-4.189	-4.196	-4.202	-4.209	-4.215	-4.221	-4.226	-4.226	-220	
-350	-4.102	-4.106	-4.111	-4.115	-4.120	-4.124	-4.128	-4.133	-4.137	-4.141	-4.145	-350	-210	-4.083	-4.091	-4.100	-4.108	-4.116	-4.124	-4.132	-4.140	-4.147	-4.154	-4.162	-4.162	-210	
-340	-4.054	-4.059	-4.064	-4.068	-4.073	-4.078	-4.083	-4.088	-4.092	-4.097	-4.102	-340	-210	-4.083	-4.091	-4.100	-4.108	-4.116	-4.124	-4.132	-4.140	-4.147	-4.154	-4.162	-4.162	-210	
-330	-4.001	-4.007	-4.012	-4.017	-4.023	-4.028	-4.033	-4.038	-4.043	-4.049	-4.054	-330	-200	-3.990	-4.000	-4.010	-4.020	-4.029	-4.038	-4.048	-4.057	-4.066	-4.074	-4.083	-4.083	-200	
-320	-3.945	-3.951	-3.957	-3.962	-3.968	-3.974	-3.979	-3.985	-3.990	-3.996	-4.001	-320	-200	-3.990	-4.000	-4.010	-4.020	-4.029	-4.038	-4.048	-4.057	-4.066	-4.074	-4.083	-4.083	-200	
-310	-3.884	-3.891	-3.897	-3.903	-3.909	-3.915	-3.921	-3.927	-3.933	-3.939	-3.945	-310	-190	-3.884	-3.896	-3.907	-3.918	-3.928	-3.939	-3.950	-3.960	-3.970	-3.980	-3.990	-3.990	-190	
-300	-3.820	-3.827	-3.833	-3.840	-3.846	-3.853	-3.859	-3.866	-3.872	-3.878	-3.884	-300	-180	-3.766	-3.778	-3.790	-3.803	-3.815	-3.827	-3.838	-3.850	-3.862	-3.873	-3.884	-3.884	-180	
-290	-3.752	-3.759	-3.766	-3.773	-3.779	-3.786	-3.793	-3.800	-3.807	-3.813	-3.820	-290	-180	-3.766	-3.778	-3.790	-3.803	-3.815	-3.827	-3.838	-3.850	-3.862	-3.873	-3.884	-3.884	-180	
-280	-3.679	-3.687	-3.694	-3.702	-3.709	-3.716	-3.723	-3.730	-3.738	-3.745	-3.752	-280	-170	-3.634	-3.648	-3.662	-3.675	-3.688	-3.702	-3.715	-3.728	-3.740	-3.753	-3.766	-3.766	-170	
-270	-3.604	-3.611	-3.619	-3.627	-3.634	-3.642	-3.650	-3.657	-3.665	-3.672	-3.679	-270	-160	-3.491	-3.506	-3.521	-3.535	-3.550	-3.564	-3.578	-3.593	-3.607	-3.621	-3.634	-3.634	-160	
-260	-3.524	-3.532	-3.540	-3.548	-3.556	-3.564	-3.572	-3.580	-3.588	-3.596	-3.604	-260	-160	-3.491	-3.506	-3.521	-3.535	-3.550	-3.564	-3.578	-3.593	-3.607	-3.621	-3.634	-3.634	-160	
-250	-3.441	-3.449	-3.458	-3.466	-3.474	-3.483	-3.491	-3.499	-3.508	-3.516	-3.524	-250	-150	-3.336	-3.352	-3.368	-3.384	-3.400	-3.415	-3.431	-3.446	-3.461	-3.476	-3.491	-3.491	-150	
-240	-3.354	-3.363	-3.372	-3.380	-3.389	-3.398	-3.407	-3.415	-3.424	-3.432	-3.441	-240	-150	-3.336	-3.352	-3.368	-3.384	-3.400	-3.415	-3.431	-3.446	-3.461	-3.476	-3.491	-3.491	-150	
-230	-3.264	-3.273	-3.282	-3.291	-3.300	-3.309	-3.318	-3.327	-3.336	-3.345	-3.354	-230	-140	-3.171	-3.188	-3.205	-3.221	-3.238	-3.255	-3.271	-3.288	-3.304	-3.320	-3.336	-3.336	-140	
-220	-3.171	-3.180	-3.189	-3.199	-3.208	-3.218	-3.227	-3.236	-3.246	-3.255	-3.264	-220	-140	-3.171	-3.188	-3.205	-3.221	-3.238	-3.255	-3.271	-3.288	-3.304	-3.320	-3.336	-3.336	-140	
-210	-3.074	-3.084	-3.093	-3.103	-3.113	-3.123	-3.132	-3.142	-3.151	-3.161	-3.171	-210	-130	-2.994	-3.012	-3.030	-3.048	-3.066	-3.084	-3.101	-3.119	-3.136	-3.153	-3.171	-3.171	-130	
-200	-2.974	-2.984	-2.994	-3.004	-3.014	-3.024	-3.034	-3.044	-3.054	-3.064	-3.074	-200	-120	-2.808	-2.827	-2.846	-2.865	-2.883	-2.902	-2.921	-2.939	-2.958	-2.976	-2.994	-2.994	-120	
-190	-2.871	-2.881	-2.892	-2.902	-2.912	-2.923	-2.933	-2.943	-2.954	-2.964	-2.974	-190	-110	-2.612	-2.632	-2.652	-2.672	-2.691	-2.711	-2.730	-2.750	-2.769	-2.789	-2.808	-2.808	-110	
-180	-2.765	-2.776	-2.786	-2.797	-2.808	-2.818	-2.829	-2.839	-2.850	-2.860	-2.871	-180	-110	-2.612	-2.632	-2.652	-2.672	-2.691	-2.711	-2.730	-2.750	-2.769	-2.789	-2.808	-2.808	-110	
-170	-2.656	-2.667	-2.678	-2.689	-2.700	-2.711	-2.722	-2.733	-2.743	-2.754	-2.765	-170	-100	-2.407	-2.428	-2.448	-2.469	-2.490	-2.510	-2.531	-2.551	-2.571	-2.592	-2.612	-2.612	-100	
-160	-2.544	-2.556	-2.567	-2.578	-2.589	-2.601	-2.612	-2.623	-2.634	-2.645	-2.656	-160	-100	-2.407	-2.428	-2.448	-2.469	-2.490	-2.510	-2.531	-2.551	-2.571	-2.592	-2.612	-2.612	-100	
-150	-2.430	-2.442	-2.453	-2.465	-2.476	-2.488	-2.499	-2.510	-2.522	-2.533	-2.544	-150	-90	-2.193	-2.215	-2.237	-2.258	-2.280	-2.301	-2.322	-2.344	-2.365	-2.386	-2.407	-2.407	-90	
-140	-2.313	-2.325	-2.337	-2.348	-2.360	-2.372	-2.384	-2.395	-2.407	-2.418	-2.430	-140	-80	-1.972	-1.995	-2.017	-2.039	-2.062	-2.084	-2.106	-2.128	-2.150	-2.172	-2.193	-2.193	-80	
-130	-2.193	-2.206	-2.218	-2.230	-2.242	-2.254	-2.265	-2.277	-2.289	-2.301	-2.313	-130	-80	-1.972	-1.995	-2.017	-2.039	-2.062	-2.084	-2.106	-2.128	-2.150	-2.172	-2.193	-2.193	-80	
-120	-2.072	-2.084	-2.096	-2.108	-2.121	-2.133	-2.145	-2.157	-2.169	-2.181	-2.193	-120	-70	-1.744	-1.767	-1.790	-1.813	-1.836	-1.859	-1.882	-1.905	-1.927	-1.950	-1.972	-1.972	-70	
-110	-1.947	-1.960	-1.972	-1.985	-1.997	-2.010	-2.022	-2.035	-2.047	-2.059	-2.072	-110	-60	-1.509	-1.533	-1.557	-1.580	-1.604	-1.627	-1.651	-1.674	-1.698	-1.721	-1.744	-1.744	-60	
-100	-1.821	-1.834	-1.846	-1.859	-1.872	-1.884	-1.897	-1.910	-1.922	-1.935	-1.947	-100	-50	-1.269	-1.293	-1.317	-1.341	-1.366	-1.390	-1.414	-1.438	-1.462	-1.485	-1.509	-1.509	-50	
-90	-1.692	-1.705	-1.718	-1.731	-1.744	-1.757	-1.770	-1.783	-1.795	-1.808	-1.821	-90	-40	-1.023	-1.048	-1.072	-1.097	-1.122	-1.146	-1.171	-1.195	-1.220	-1.244	-1.269	-1.269	-40	
-80	-1.562	-1.575	-1.588	-1.601	-1.614	-1.627	-1.640	-1.653	-1.666	-1.679	-1.692	-80	-40	-1.023	-1.048	-1.072	-1.097	-1.122	-1.146	-1.171	-1.195	-1.220	-1.244	-1.269	-1.269	-40	
-70	-1.430	-1.443	-1.456	-1.470	-1.483	-1.496	-1.509	-1.522	-1.536	-1.549	-1.562	-70	-30	-0.772	-0.798	-0.823	-0.848	-0.873	-0.898	-0.923	-0.948	-0.973	-0.998	-1.023	-1.023	-30	
-60	-1.296	-1.309	-1.323	-1.336	-1.349	-1.363	-1.376	-1.390	-1.403	-1.416	-1.430	-60	-30	-0.772	-0.798	-0.823	-0.848	-0.873	-0.898	-0.923	-0.948	-0.973	-0.998	-1.023	-1.023	-30	
-50	-1.160	-1.174	-1.187	-1.201	-1.214	-1.228	-1.242	-1.255	-1.269	-1.282	-1.296	-50	-20	-0.518	-0.544	-0.569	-0.595	-0.620	-0.646	-0.671	-0.696	-0.722	-0.747	-0.772	-0.772	-20	
-40	-1.023	-1.037	-1.050	-1.064	-1.078	-1.092	-1.105	-1.119	-1.133	-1.146	-1.160	-40	-20	-0.518	-0.544	-0.569	-0.595	-0.620	-0.646	-0.671	-0.696	-0.722	-0.747	-0.772	-0.772	-20	
-30	-0.884	-0																									

50 °F - 550 °F

## Type N - Nicrosil vs Nisil

50 °C - 350 °C

°F	0	1	2	3	4	5	6	7	8	9	10	°F	°C	0	1	2	3	4	5	6	7	8	9	10	°C	
EMF in Millivolts — Reference Junction 32°F												EMF in Millivolts — Reference Junctions 0 °C														
50	0.261	0.275	0.290	0.305	0.319	0.334	0.349	0.363	0.378	0.393	0.407	50	50	1.340	1.368	1.395	1.423	1.451	1.479	1.507	1.535	1.563	1.591	1.619	50	
60	0.407	0.422	0.437	0.451	0.466	0.481	0.496	0.510	0.525	0.540	0.555	60	60	1.619	1.647	1.675	1.703	1.732	1.760	1.788	1.817	1.845	1.873	1.902	60	
70	0.555	0.570	0.584	0.599	0.614	0.629	0.644	0.659	0.674	0.688	0.703	70	70	1.902	1.930	1.959	1.988	2.016	2.045	2.074	2.102	2.131	2.160	2.189	70	
80	0.703	0.718	0.733	0.748	0.763	0.778	0.793	0.808	0.823	0.838	0.853	80	80	2.189	2.218	2.247	2.276	2.305	2.334	2.363	2.392	2.421	2.450	2.480	80	
90	0.853	0.868	0.883	0.898	0.913	0.928	0.943	0.958	0.974	0.989	1.004	90	90	2.480	2.509	2.538	2.568	2.597	2.626	2.656	2.685	2.715	2.744	2.774	90	
100	1.004	1.019	1.034	1.049	1.065	1.080	1.095	1.110	1.125	1.141	1.156	100	100	2.774	2.804	2.833	2.863	2.893	2.923	2.953	2.983	3.012	3.042	3.072	100	
110	1.156	1.171	1.186	1.202	1.217	1.232	1.248	1.263	1.278	1.294	1.309	110	110	3.072	3.102	3.133	3.163	3.193	3.223	3.253	3.283	3.314	3.344	3.374	110	
120	1.309	1.324	1.340	1.355	1.371	1.386	1.402	1.417	1.432	1.448	1.463	120	120	3.374	3.405	3.435	3.466	3.496	3.527	3.557	3.588	3.619	3.649	3.680	120	
130	1.463	1.479	1.494	1.510	1.525	1.541	1.557	1.572	1.588	1.603	1.619	130	130	3.680	3.711	3.742	3.772	3.803	3.834	3.865	3.896	3.927	3.958	3.989	130	
140	1.619	1.635	1.650	1.666	1.682	1.697	1.713	1.729	1.744	1.760	1.776	140	140	3.989	4.020	4.051	4.083	4.114	4.145	4.176	4.208	4.239	4.270	4.302	140	
150	1.776	1.791	1.807	1.823	1.839	1.855	1.870	1.886	1.902	1.918	1.934	150	150	4.302	4.333	4.365	4.396	4.428	4.459	4.491	4.523	4.554	4.586	4.618	150	
160	1.934	1.950	1.965	1.981	1.997	2.013	2.029	2.045	2.061	2.077	2.093	160	160	4.618	4.650	4.681	4.713	4.745	4.777	4.809	4.841	4.873	4.905	4.937	160	
170	2.093	2.109	2.125	2.141	2.157	2.173	2.189	2.205	2.221	2.237	2.253	170	170	4.937	4.969	5.001	5.033	5.066	5.098	5.130	5.162	5.195	5.227	5.259	170	
180	2.253	2.269	2.285	2.301	2.318	2.334	2.350	2.366	2.382	2.398	2.415	180	180	5.259	5.292	5.324	5.357	5.389	5.422	5.454	5.487	5.520	5.552	5.585	180	
190	2.415	2.431	2.447	2.463	2.480	2.496	2.512	2.528	2.545	2.561	2.577	190	190	5.585	5.618	5.650	5.683	5.716	5.749	5.782	5.815	5.847	5.880	5.913	190	
200	2.577	2.594	2.610	2.626	2.643	2.659	2.676	2.692	2.708	2.725	2.741	200	200	5.913	5.946	5.979	6.013	6.046	6.079	6.112	6.145	6.178	6.211	6.245	200	
210	2.741	2.758	2.774	2.791	2.807	2.824	2.840	2.857	2.873	2.890	2.906	210	210	6.245	6.278	6.311	6.345	6.378	6.411	6.445	6.478	6.512	6.545	6.579	210	
220	2.906	2.923	2.939	2.956	2.973	2.989	3.006	3.022	3.039	3.056	3.072	220	220	6.579	6.612	6.646	6.680	6.713	6.747	6.781	6.814	6.848	6.882	6.916	220	
230	3.072	3.089	3.106	3.123	3.139	3.156	3.173	3.189	3.206	3.223	3.240	230	230	6.916	6.949	6.983	7.017	7.051	7.085	7.119	7.153	7.187	7.221	7.255	230	
240	3.240	3.257	3.273	3.290	3.307	3.324	3.341	3.358	3.374	3.391	3.408	240	240	7.255	7.289	7.323	7.357	7.392	7.426	7.460	7.494	7.528	7.563	7.597	240	
250	3.408	3.425	3.442	3.459	3.476	3.493	3.510	3.527	3.544	3.561	3.578	250	250	7.597	7.631	7.666	7.700	7.734	7.769	7.803	7.838	7.872	7.907	7.941	250	
260	3.578	3.595	3.612	3.629	3.646	3.663	3.680	3.697	3.714	3.731	3.748	260	260	7.941	7.976	8.010	8.045	8.080	8.114	8.149	8.184	8.218	8.253	8.288	260	
270	3.748	3.766	3.783	3.800	3.817	3.834	3.851	3.869	3.886	3.903	3.920	270	270	8.288	8.323	8.358	8.392	8.427	8.462	8.497	8.532	8.567	8.602	8.637	270	
280	3.920	3.937	3.955	3.972	3.989	4.007	4.024	4.041	4.058	4.076	4.093	280	280	8.637	8.672	8.707	8.742	8.777	8.812	8.847	8.882	8.918	8.953	8.988	280	
290	4.093	4.110	4.128	4.145	4.162	4.180	4.197	4.215	4.232	4.250	4.267	290	290	8.988	9.023	9.058	9.094	9.129	9.164	9.200	9.235	9.270	9.306	9.341	290	
300	4.267	4.284	4.302	4.319	4.337	4.354	4.372	4.389	4.407	4.424	4.442	300	300	9.341	9.377	9.412	9.448	9.483	9.519	9.554	9.590	9.625	9.661	9.696	300	
310	4.442	4.459	4.477	4.495	4.512	4.530	4.547	4.565	4.583	4.600	4.618	310	310	9.696	9.732	9.768	9.803	9.839	9.875	9.910	9.946	9.982	10.018	10.054	310	
320	4.618	4.635	4.653	4.671	4.688	4.706	4.724	4.742	4.759	4.777	4.795	320	320	10.054	10.089	10.125	10.161	10.197	10.233	10.269	10.305	10.341	10.377	10.413	320	
330	4.795	4.813	4.830	4.848	4.866	4.884	4.901	4.919	4.937	4.955	4.973	330	330	10.413	10.449	10.485	10.521	10.557	10.593	10.629	10.665	10.701	10.737	10.774	330	
340	4.973	4.991	5.008	5.026	5.044	5.062	5.080	5.098	5.116	5.134	5.152	340	340	10.774	10.810	10.846	10.882	10.918	10.955	10.991	11.027	11.064	11.100	11.136	340	
350	5.152	5.170	5.188	5.206	5.224	5.241	5.259	5.277	5.295	5.314	5.332	350	350													350
360	5.332	5.350	5.368	5.386	5.404	5.422	5.440	5.458	5.476	5.494	5.512	360	360													360
370	5.512	5.531	5.549	5.567	5.585	5.603	5.621	5.639	5.658	5.676	5.694	370	370													370
380	5.694	5.712	5.731	5.749	5.767	5.785	5.804	5.822	5.840	5.858	5.877	380	380													380
390	5.877	5.895	5.913	5.932	5.950	5.968	5.987	6.005	6.024	6.042	6.060	390	390													390
400	6.060	6.079	6.097	6.116	6.134	6.152	6.171	6.189	6.208	6.226	6.245	400	400													400
410	6.245	6.263	6.282	6.300	6.319	6.337	6.356	6.374	6.393	6.411	6.430	410	410													410
420	6.430	6.449	6.467	6.486	6.504	6.523	6.542	6.560	6.579	6.597	6.616	420	420													420
430	6.616	6.635	6.653	6.672	6.691	6.710	6.728	6.747	6.766	6.784	6.803	430	430													430
440	6.803	6.822	6.841	6.859	6.878	6.897	6.916	6.934	6.953	6.972	6.991	440	440													440
450	6.991	7.010	7.029	7.047	7.066	7.085	7.104	7.123	7.142	7.161	7.179	450	450													450
460	7.179	7.198	7.217	7.236	7.255	7.274	7.293	7.312	7.331	7.350	7.369	460	460													460
470	7.369	7.388	7.407	7.426	7.445	7.464	7.483	7.502	7.521	7.540	7.559	470	470													470
480	7.559	7.578	7.597	7.616	7.635	7.654	7.673	7.692	7.711	7.731	7.750	480	480													480
490	7.750	7.769	7.788	7.807	7.826	7.845	7.865	7.884	7.903	7.922	7.941	490	490													490
500	7.941	7.960	7.980	7.999	8.018	8.037	8.057	8.076	8.095	8.114	8.134	500	500													500
510	8.134	8.153	8.172	8.191	8.211	8.230	8.249	8.269	8.288	8.307	8.327	510	510													510
520	8.327	8.346	8.365	8.385	8.404	8.423	8.443	8.462	8.482	8.501	8.520	520	520													520
530	8.520	8.540	8.559	8.579	8.598	8.617	8.637	8.656	8.676	8.695	8.715	530	530													530
540	8.715	8.734	8.754	8.773	8.793	8.812	8.832	8.851	8.871	8.890	8.910	540	540													540

°F	0	1	2	3	4	5	6	7	8	9	10	°F	°C	0	1	2	3	4	5	6	7	8	9	10	°C
<b>EMF in Millivolts — Reference Junction 32°F</b>												<b>EMF in Millivolts — Reference Junctions 0 °C</b>													
550	8.910	8.929	8.949	8.968	8.988	9.008	9.027	9.047	9.066	9.086	9.105	550	350	11.136	11.173	11.209	11.245	11.282	11.318	11.355	11.391	11.428	11.464	11.501	350
560	9.105	9.125	9.145	9.164	9.184	9.204	9.223	9.243	9.262	9.282	9.302	560	360	11.501	11.537	11.574	11.610	11.647	11.683	11.720	11.757	11.793	11.830	11.867	360
570	9.302	9.321	9.341	9.361	9.381	9.400	9.420	9.440	9.459	9.479	9.499	570	370	11.867	11.903	11.940	11.977	12.013	12.050	12.087	12.124	12.160	12.197	12.234	370
580	9.499	9.519	9.538	9.558	9.578	9.598	9.617	9.637	9.657	9.677	9.696	580	380	12.234	12.271	12.308	12.345	12.382	12.418	12.455	12.492	12.529	12.566	12.603	380
590	9.696	9.716	9.736	9.756	9.776	9.795	9.815	9.835	9.855	9.875	9.895	590	390	12.603	12.640	12.677	12.714	12.751	12.788	12.825	12.862	12.899	12.937	12.974	390
600	9.895	9.914	9.934	9.954	9.974	9.994	10.014	10.034	10.054	10.073	10.093	600	400	12.974	13.011	13.048	13.085	13.122	13.159	13.197	13.234	13.271	13.308	13.346	400
610	10.093	10.113	10.133	10.153	10.173	10.193	10.213	10.233	10.253	10.273	10.293	610	410	13.346	13.383	13.420	13.457	13.495	13.532	13.569	13.607	13.644	13.682	13.719	410
620	10.293	10.313	10.333	10.353	10.373	10.393	10.413	10.433	10.453	10.473	10.493	620	420	13.719	13.756	13.794	13.831	13.869	13.906	13.944	13.981	14.019	14.056	14.094	420
630	10.493	10.513	10.533	10.553	10.573	10.593	10.613	10.633	10.653	10.673	10.693	630	430	14.094	14.131	14.169	14.206	14.244	14.281	14.319	14.356	14.394	14.432	14.469	430
640	10.693	10.713	10.733	10.753	10.774	10.794	10.814	10.834	10.854	10.874	10.894	640	440	14.469	14.507	14.545	14.582	14.620	14.658	14.695	14.733	14.771	14.809	14.846	440
650	10.894	10.914	10.934	10.955	10.975	10.995	11.015	11.035	11.055	11.076	11.096	650	450	14.846	14.884	14.922	14.960	14.998	15.035	15.073	15.111	15.149	15.187	15.225	450
660	11.096	11.116	11.136	11.156	11.177	11.197	11.217	11.237	11.257	11.278	11.298	660	460	15.225	15.262	15.300	15.338	15.376	15.414	15.452	15.490	15.528	15.566	15.604	460
670	11.298	11.318	11.338	11.359	11.379	11.399	11.419	11.440	11.460	11.480	11.501	670	470	15.604	15.642	15.680	15.718	15.756	15.794	15.832	15.870	15.908	15.946	15.984	470
680	11.501	11.521	11.541	11.561	11.582	11.602	11.622	11.643	11.663	11.683	11.704	680	480	15.984	16.022	16.060	16.099	16.137	16.175	16.213	16.251	16.289	16.327	16.366	480
690	11.704	11.724	11.744	11.765	11.785	11.805	11.826	11.846	11.867	11.887	11.907	690	490	16.366	16.404	16.442	16.480	16.518	16.557	16.595	16.633	16.671	16.710	16.748	490
700	11.907	11.928	11.948	11.968	11.989	12.009	12.030	12.050	12.071	12.091	12.111	700	500	16.748	16.786	16.824	16.863	16.901	16.939	16.978	17.016	17.054	17.093	17.131	500
710	12.111	12.132	12.152	12.173	12.193	12.214	12.234	12.255	12.275	12.295	12.316	710	510	17.131	17.169	17.208	17.246	17.285	17.323	17.361	17.400	17.438	17.477	17.515	510
720	12.316	12.336	12.357	12.377	12.398	12.418	12.439	12.459	12.480	12.500	12.521	720	520	17.515	17.554	17.592	17.630	17.669	17.707	17.746	17.784	17.823	17.861	17.900	520
730	12.521	12.542	12.562	12.583	12.603	12.624	12.644	12.665	12.685	12.706	12.726	730	530	17.900	17.938	17.977	18.016	18.054	18.093	18.131	18.170	18.208	18.247	18.286	530
740	12.726	12.747	12.768	12.788	12.809	12.829	12.850	12.871	12.891	12.912	12.932	740	540	18.286	18.324	18.363	18.401	18.440	18.479	18.517	18.556	18.595	18.633	18.672	540
750	12.932	12.953	12.974	12.994	13.015	13.036	13.056	13.077	13.098	13.118	13.139	750	550	18.672	18.711	18.749	18.788	18.827	18.865	18.904	18.943	18.982	19.020	19.059	550
760	13.139	13.159	13.180	13.201	13.221	13.242	13.263	13.284	13.304	13.325	13.346	760	560	19.059	19.098	19.136	19.175	19.214	19.253	19.292	19.330	19.369	19.408	19.447	560
770	13.346	13.366	13.387	13.408	13.428	13.449	13.470	13.491	13.511	13.532	13.553	770	570	19.447	19.485	19.524	19.563	19.602	19.641	19.680	19.718	19.757	19.796	19.835	570
780	13.553	13.574	13.594	13.615	13.636	13.657	13.677	13.698	13.719	13.740	13.760	780	580	19.835	19.874	19.913	19.952	19.990	20.029	20.068	20.107	20.146	20.185	20.224	580
790	13.760	13.781	13.802	13.823	13.844	13.864	13.885	13.906	13.927	13.948	13.969	790	590	20.224	20.263	20.302	20.341	20.379	20.418	20.457	20.496	20.535	20.574	20.613	590
800	13.969	13.989	14.010	14.031	14.052	14.073	14.094	14.114	14.135	14.156	14.177	800	600	20.613	20.652	20.691	20.730	20.769	20.808	20.847	20.886	20.925	20.964	21.003	600
810	14.177	14.198	14.219	14.240	14.260	14.281	14.302	14.323	14.344	14.365	14.386	810	610	21.003	21.042	21.081	21.120	21.159	21.198	21.237	21.276	21.315	21.354	21.393	610
820	14.386	14.407	14.428	14.448	14.469	14.490	14.511	14.532	14.553	14.574	14.595	820	620	21.393	21.432	21.471	21.510	21.549	21.588	21.628	21.667	21.706	21.745	21.784	620
830	14.595	14.616	14.637	14.658	14.679	14.700	14.721	14.742	14.763	14.784	14.804	830	630	21.784	21.823	21.862	21.901	21.940	21.979	22.018	22.058	22.097	22.136	22.175	630
840	14.804	14.825	14.846	14.867	14.888	14.909	14.930	14.951	14.972	14.993	15.014	840	640	22.175	22.214	22.253	22.292	22.331	22.370	22.410	22.449	22.488	22.527	22.566	640
850	15.014	15.035	15.056	15.077	15.098	15.119	15.140	15.162	15.183	15.204	15.225	850	650												650
860	15.225	15.246	15.267	15.288	15.309	15.330	15.351	15.372	15.393	15.414	15.435	860													
870	15.435	15.456	15.477	15.498	15.520	15.541	15.562	15.583	15.604	15.625	15.646	870													
880	15.646	15.667	15.688	15.709	15.731	15.752	15.773	15.794	15.815	15.836	15.857	880													
890	15.857	15.878	15.900	15.921	15.942	15.963	15.984	16.005	16.027	16.048	16.069	890													
900	16.069	16.090	16.111	16.132	16.154	16.175	16.196	16.217	16.238	16.260	16.281	900													
910	16.281	16.302	16.323	16.344	16.366	16.387	16.408	16.429	16.450	16.472	16.493	910													
920	16.493	16.514	16.535	16.557	16.578	16.599	16.620	16.642	16.663	16.684	16.705	920													
930	16.705	16.727	16.748	16.769	16.790	16.812	16.833	16.854	16.875	16.897	16.918	930													
940	16.918	16.939	16.961	16.982	17.003	17.025	17.046	17.067	17.088	17.110	17.131	940													
950	17.131	17.152	17.174	17.195	17.216	17.238	17.259	17.280	17.302	17.323	17.344	950													
960	17.344	17.366	17.387	17.408	17.430	17.451	17.472	17.494	17.515	17.536	17.558	960													
970	17.558	17.579	17.601	17.622	17.643	17.665	17.686	17.707	17.729	17.750	17.772	970													
980	17.772	17.793	17.814	17.836	17.857	17.879	17.900	17.921	17.943	17.964	17.986	980													
990	17.986	18.007	18.028	18.050	18.071	18.093	18.114	18.136	18.157	18.178	18.200	990													
1000	18.200	18.221	18.243	18.264	18.286	18.307	18.328	18.350	18.371	18.393	18.414	1000													
1010	18.414	18.436	18.457	18.479	18.500	18.522	18.543	18.565	18.586	18.608	18.629	1010													
1020	18.629	18.650	18.672	18.693	18.715	18.736	18.758	18.779	18.801	18.822	18.844	1020													
1030	18.844	18.865	18.887	18.908	18.930	18.951	18.973	18.994	19.016	19.037	19.059	1030													

1050 °F - 1550 °F

## Type N - Nicrosil vs Nisil

650 °C - 950 °C

°F	0	1	2	3	4	5	6	7	8	9	10	°F	°C	0	1	2	3	4	5	6	7	8	9	10	°C
EMF in Millivolts — Reference Junction 32°F													EMF in Millivolts — Reference Junctions 0 °C												
1050	19.274	19.296	19.317	19.339	19.360	19.382	19.404	19.425	19.447	19.468	19.490	1050	650	22.566	22.605	22.644	22.684	22.723	22.762	22.801	22.840	22.879	22.919	22.958	650
1060	19.490	19.511	19.533	19.554	19.576	19.598	19.619	19.641	19.662	19.684	19.705	1060	660	22.958	22.997	23.036	23.075	23.115	23.154	23.193	23.232	23.271	23.311	23.350	660
1070	19.705	19.727	19.749	19.770	19.792	19.813	19.835	19.857	19.878	19.900	19.921	1070	670	23.350	23.389	23.428	23.467	23.507	23.546	23.585	23.624	23.663	23.703	23.742	670
1080	19.921	19.943	19.964	19.986	20.008	20.029	20.051	20.072	20.094	20.116	20.137	1080	680	23.742	23.781	23.820	23.860	23.899	23.938	23.977	24.016	24.056	24.095	24.134	680
1090	20.137	20.159	20.181	20.202	20.224	20.245	20.267	20.289	20.310	20.332	20.353	1090	690	24.134	24.173	24.213	24.252	24.291	24.330	24.370	24.409	24.448	24.487	24.527	690
1100	20.353	20.375	20.397	20.418	20.440	20.462	20.483	20.505	20.527	20.548	20.570	1100	700	24.527	24.566	24.605	24.644	24.684	24.723	24.762	24.801	24.841	24.880	24.919	700
1110	20.570	20.591	20.613	20.635	20.656	20.678	20.700	20.721	20.743	20.765	20.786	1110	710	24.919	24.959	24.998	25.037	25.076	25.116	25.155	25.194	25.233	25.273	25.312	710
1120	20.786	20.808	20.830	20.851	20.873	20.895	20.916	20.938	20.960	20.981	21.003	1120	720	25.312	25.351	25.391	25.430	25.469	25.508	25.548	25.587	25.626	25.666	25.705	720
1130	21.003	21.025	21.046	21.068	21.090	21.111	21.133	21.155	21.176	21.198	21.220	1130	730	25.705	25.744	25.783	25.823	25.862	25.901	25.941	25.980	26.019	26.058	26.098	730
1140	21.220	21.241	21.263	21.285	21.306	21.328	21.350	21.371	21.393	21.415	21.437	1140	740	26.098	26.137	26.176	26.216	26.255	26.294	26.333	26.373	26.412	26.451	26.491	740
1150	21.437	21.458	21.480	21.502	21.523	21.545	21.567	21.588	21.610	21.632	21.654	1150	750	26.491	26.530	26.569	26.608	26.648	26.687	26.726	26.766	26.805	26.844	26.883	750
1160	21.654	21.675	21.697	21.719	21.740	21.762	21.784	21.806	21.827	21.849	21.871	1160	760	26.883	26.923	26.962	27.001	27.041	27.080	27.119	27.158	27.198	27.237	27.276	760
1170	21.871	21.892	21.914	21.936	21.958	21.979	22.001	22.023	22.044	22.066	22.088	1170	770	27.276	27.316	27.355	27.394	27.433	27.473	27.512	27.551	27.591	27.630	27.669	770
1180	22.088	22.110	22.131	22.153	22.175	22.197	22.218	22.240	22.262	22.284	22.305	1180	780	27.669	27.708	27.748	27.787	27.826	27.866	27.905	27.944	27.983	28.023	28.062	780
1190	22.305	22.327	22.349	22.370	22.392	22.414	22.436	22.457	22.479	22.501	22.523	1190	790	28.062	28.101	28.140	28.180	28.219	28.258	28.297	28.337	28.376	28.415	28.455	790
1200	22.523	22.544	22.566	22.588	22.610	22.631	22.653	22.675	22.697	22.718	22.740	1200	800	28.455	28.494	28.533	28.572	28.612	28.651	28.690	28.729	28.769	28.808	28.847	800
1210	22.740	22.762	22.784	22.805	22.827	22.849	22.871	22.893	22.914	22.936	22.958	1210	810	28.847	28.886	28.926	28.965	29.004	29.043	29.083	29.122	29.161	29.200	29.239	810
1220	22.958	22.980	23.001	23.023	23.045	23.067	23.088	23.110	23.132	23.154	23.176	1220	820	29.239	29.279	29.318	29.357	29.396	29.436	29.475	29.514	29.553	29.592	29.632	820
1230	23.176	23.197	23.219	23.241	23.263	23.284	23.306	23.328	23.350	23.372	23.393	1230	830	29.632	29.671	29.710	29.749	29.789	29.828	29.867	29.906	29.945	29.985	30.024	830
1240	23.393	23.415	23.437	23.459	23.480	23.502	23.524	23.546	23.568	23.589	23.611	1240	840	30.024	30.063	30.102	30.141	30.181	30.220	30.259	30.298	30.337	30.376	30.416	840
1250	23.611	23.633	23.655	23.676	23.698	23.720	23.742	23.764	23.785	23.807	23.829	1250	850	30.416	30.455	30.494	30.533	30.572	30.611	30.651	30.690	30.729	30.768	30.807	850
1260	23.829	23.851	23.873	23.894	23.916	23.938	23.960	23.982	24.003	24.025	24.047	1260	860	30.807	30.846	30.886	30.925	30.964	31.003	31.042	31.081	31.120	31.160	31.199	860
1270	24.047	24.069	24.091	24.112	24.134	24.156	24.178	24.200	24.221	24.243	24.265	1270	870	31.199	31.238	31.277	31.316	31.355	31.394	31.433	31.473	31.512	31.551	31.590	870
1280	24.265	24.287	24.309	24.330	24.352	24.374	24.396	24.418	24.439	24.461	24.483	1280	880	31.590	31.629	31.668	31.707	31.746	31.785	31.824	31.863	31.903	31.942	31.981	880
1290	24.483	24.505	24.527	24.548	24.570	24.592	24.614	24.636	24.658	24.679	24.701	1290	890	31.981	32.020	32.059	32.098	32.137	32.176	32.215	32.254	32.293	32.332	32.371	890
1300	24.701	24.723	24.745	24.767	24.788	24.810	24.832	24.854	24.876	24.897	24.919	1300	900	32.371	32.410	32.449	32.488	32.527	32.566	32.605	32.644	32.683	32.722	32.761	900
1310	24.919	24.941	24.963	24.985	25.007	25.028	25.050	25.072	25.094	25.116	25.137	1310	910	32.761	32.800	32.839	32.878	32.917	32.956	32.995	33.034	33.073	33.112	33.151	910
1320	25.137	25.159	25.181	25.203	25.225	25.247	25.268	25.290	25.312	25.334	25.356	1320	920	33.151	33.190	33.229	33.268	33.307	33.346	33.385	33.424	33.463	33.502	33.541	920
1330	25.356	25.377	25.399	25.421	25.443	25.465	25.487	25.508	25.530	25.552	25.574	1330	930	33.541	33.580	33.619	33.658	33.697	33.736	33.774	33.813	33.852	33.891	33.930	930
1340	25.574	25.596	25.618	25.639	25.661	25.683	25.705	25.727	25.748	25.770	25.792	1340	940	33.930	33.969	34.008	34.047	34.086	34.124	34.163	34.202	34.241	34.280	34.319	940
1350	25.792	25.814	25.836	25.858	25.879	25.901	25.923	25.945	25.967	25.989	26.010	1350													
1360	26.010	26.032	26.054	26.076	26.098	26.119	26.141	26.163	26.185	26.207	26.229	1360													
1370	26.229	26.250	26.272	26.294	26.316	26.338	26.360	26.381	26.403	26.425	26.447	1370													
1380	26.447	26.469	26.491	26.512	26.534	26.556	26.578	26.600	26.622	26.643	26.665	1380													
1390	26.665	26.687	26.709	26.731	26.752	26.774	26.796	26.818	26.840	26.862	26.883	1390													
1400	26.883	26.905	26.927	26.949	26.971	26.993	27.014	27.036	27.058	27.080	27.102	1400													
1410	27.102	27.124	27.145	27.167	27.189	27.211	27.233	27.254	27.276	27.298	27.320	1410													
1420	27.320	27.342	27.364	27.385	27.407	27.429	27.451	27.473	27.495	27.516	27.538	1420													
1430	27.538	27.560	27.582	27.604	27.625	27.647	27.669	27.691	27.713	27.735	27.756	1430													
1440	27.756	27.778	27.800	27.822	27.844	27.866	27.887	27.909	27.931	27.953	27.975	1440													
1450	27.975	27.996	28.018	28.040	28.062	28.084	28.105	28.127	28.149	28.171	28.193	1450													
1460	28.193	28.215	28.236	28.258	28.280	28.302	28.324	28.345	28.367	28.389	28.411	1460													
1470	28.411	28.433	28.455	28.476	28.498	28.520	28.542	28.564	28.585	28.607	28.629	1470													
1480	28.629	28.651	28.673	28.694	28.716	28.738	28.760	28.782	28.803	28.825	28.847	1480													
1490	28.847	28.869	28.891	28.912	28.934	28.956	28.978	29.000	29.021	29.043	29.065	1490													
1500	29.065	29.087	29.109	29.130	29.152	29.174	29.196	29.218	29.239	29.261	29.283	1500													
1510	29.283	29.305	29.327	29.348	29.370	29.392	29.414	29.436	29.457	29.479	29.501	1510													
1520	29.501	29.523	29.545	29.566	29.588	29.610	29.632	29.653	29.675	29.697	29.719														

°F											°F											°C											°C																		
EMF in Millivolts — Reference Junction 32°F											EMF in Millivolts — Reference Junctions 0 °C											EMF in Millivolts — Reference Junctions 0 °C											EMF in Millivolts — Reference Junctions 0 °C																		
0	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9	10								
1550	30.154	30.176	30.198	30.220	30.242	30.263	30.285	30.307	30.329	30.350	30.372	1550	950	34.319	34.358	34.396	34.435	34.474	34.513	34.552	34.591	34.629	34.668	34.707	1560	30.372	30.394	30.416	30.437	30.459	30.481	30.503	30.524	30.546	30.568	30.590	1560	960	34.707	34.746	34.785	34.823	34.862	34.901	34.940	34.979	35.017	35.056	35.095	960	
1560	30.372	30.394	30.416	30.437	30.459	30.481	30.503	30.524	30.546	30.568	30.590	1570	960	34.707	34.746	34.785	34.823	34.862	34.901	34.940	34.979	35.017	35.056	35.095	960	1570	30.590	30.611	30.633	30.655	30.677	30.699	30.720	30.742	30.764	30.786	30.807	1570	970	35.095	35.134	35.172	35.211	35.250	35.289	35.327	35.366	35.405	35.444	35.482	970
1570	30.807	30.830	30.852	30.874	30.896	30.918	30.940	30.962	30.984	31.006	31.028	1580	970	35.095	35.134	35.172	35.211	35.250	35.289	35.327	35.366	35.405	35.444	35.482	970	1580	30.807	30.829	30.851	30.873	30.895	30.917	30.939	30.961	30.983	31.005	31.027	1580	980	35.482	35.521	35.560	35.598	35.637	35.676	35.714	35.753	35.792	35.831	35.869	980
1580	30.890	30.912	30.934	30.956	30.978	31.000	31.022	31.044	31.066	31.088	31.110	1590	980	35.482	35.521	35.560	35.598	35.637	35.676	35.714	35.753	35.792	35.831	35.869	980	1590	31.025	31.047	31.069	31.091	31.113	31.135	31.157	31.179	31.201	31.223	31.245	1590	990	35.869	35.908	35.946	35.985	36.024	36.062	36.101	36.140	36.178	36.217	36.256	990
1590	31.025	31.047	31.069	31.091	31.113	31.135	31.157	31.179	31.201	31.223	31.245	1600	990	35.869	35.908	35.946	35.985	36.024	36.062	36.101	36.140	36.178	36.217	36.256	990	1600	31.242	31.264	31.286	31.308	31.330	31.352	31.374	31.396	31.418	31.440	31.462	1600	1000	36.256	36.294	36.333	36.371	36.410	36.449	36.487	36.526	36.564	36.603	36.641	1000
1600	31.242	31.264	31.286	31.308	31.330	31.352	31.374	31.396	31.418	31.440	31.462	1610	1000	36.256	36.294	36.333	36.371	36.410	36.449	36.487	36.526	36.564	36.603	36.641	1000	1610	31.459	31.481	31.503	31.525	31.547	31.569	31.591	31.613	31.635	31.657	31.679	1610	1010	36.641	36.680	36.718	36.757	36.796	36.834	36.873	36.911	36.950	36.988	37.027	1010
1610	31.459	31.481	31.503	31.525	31.547	31.569	31.591	31.613	31.635	31.657	31.679	1620	1010	36.641	36.680	36.718	36.757	36.796	36.834	36.873	36.911	36.950	36.988	37.027	1010	1620	31.677	31.699	31.721	31.743	31.765	31.787	31.809	31.831	31.853	31.875	31.897	1620	1020	37.027	37.065	37.104	37.142	37.181	37.219	37.258	37.296	37.334	37.373	37.411	1020
1620	31.677	31.699	31.721	31.743	31.765	31.787	31.809	31.831	31.853	31.875	31.897	1630	1020	37.027	37.065	37.104	37.142	37.181	37.219	37.258	37.296	37.334	37.373	37.411	1020	1630	31.894	31.916	31.938	31.960	31.982	32.004	32.026	32.048	32.070	32.092	32.114	1630	1030	37.411	37.450	37.488	37.527	37.565	37.603	37.642	37.680	37.719	37.757	37.795	1030
1630	31.894	31.916	31.938	31.960	31.982	32.004	32.026	32.048	32.070	32.092	32.114	1640	1030	37.411	37.450	37.488	37.527	37.565	37.603	37.642	37.680	37.719	37.757	37.795	1030	1640	32.111	32.133	32.155	32.177	32.199	32.221	32.243	32.265	32.287	32.309	32.331	1640	1040	37.795	37.834	37.872	37.911	37.949	37.987	38.026	38.064	38.102	38.141	38.179	1040
1640	32.111	32.133	32.155	32.177	32.199	32.221	32.243	32.265	32.287	32.309	32.331	1650	1040	37.795	37.834	37.872	37.911	37.949	37.987	38.026	38.064	38.102	38.141	38.179	1040	1650	32.328	32.350	32.372	32.394	32.416	32.438	32.460	32.482	32.504	32.526	32.548	1650	1050	38.179	38.217	38.256	38.294	38.332	38.370	38.409	38.447	38.485	38.524	38.562	1050
1650	32.328	32.350	32.372	32.394	32.416	32.438	32.460	32.482	32.504	32.526	32.548	1660	1050	38.179	38.217	38.256	38.294	38.332	38.370	38.409	38.447	38.485	38.524	38.562	1050	1660	32.545	32.567	32.589	32.611	32.633	32.655	32.677	32.699	32.721	32.743	32.765	1660	1060	38.562	38.600	38.638	38.677	38.715	38.753	38.791	38.829	38.868	38.906	38.944	1060
1660	32.545	32.567	32.589	32.611	32.633	32.655	32.677	32.699	32.721	32.743	32.765	1670	1060	38.562	38.600	38.638	38.677	38.715	38.753	38.791	38.829	38.868	38.906	38.944	1060	1670	32.761	32.783	32.805	32.827	32.849	32.871	32.893	32.915	32.937	32.959	32.981	1670	1070	38.944	38.982	39.020	39.059	39.097	39.135	39.173	39.211	39.249	39.287	39.326	1070
1670	32.761	32.783	32.805	32.827	32.849	32.871	32.893	32.915	32.937	32.959	32.981	1680	1070	38.944	38.982	39.020	39.059	39.097	39.135	39.173	39.211	39.249	39.287	39.326	1070	1680	32.978	33.000	33.022	33.044	33.066	33.088	33.110	33.132	33.154	33.176	33.198	1680	1080	39.326	39.364	39.402	39.440	39.478	39.516	39.554	39.592	39.630	39.668	39.706	1080
1680	32.978	33.000	33.022	33.044	33.066	33.088	33.110	33.132	33.154	33.176	33.198	1690	1080	39.326	39.364	39.402	39.440	39.478	39.516	39.554	39.592	39.630	39.668	39.706	1080	1690	33.195	33.217	33.239	33.261	33.283	33.305	33.327	33.349	33.371	33.393	33.415	1690	1090	39.706	39.744	39.782	39.821	39.859	39.897	39.935	39.973	40.011	40.049	40.087	1090
1690	33.195	33.217	33.239	33.261	33.283	33.305	33.327	33.349	33.371	33.393	33.415	1700	1090	39.706	39.744	39.782	39.821	39.859	39.897	39.935	39.973	40.011	40.049	40.087	1090	1700	33.411	33.433	33.455	33.477	33.499	33.521	33.543	33.565	33.587	33.609	33.631	1700	1100	40.087	40.125	40.163	40.201	40.238	40.276	40.314	40.352	40.390	40.428	40.466	1100
1700	33.411	33.433	33.455	33.477	33.499	33.521	33.543	33.565	33.587	33.609	33.631	1710	1100	40.087	40.125	40.163	40.201	40.238	40.276	40.314	40.352	40.390	40.428	40.466	1100	1710	33.627	33.649	33.671	33.693	33.715	33.737	33.759	33.781	33.803	33.825	33.847	1710	1110	40.466	40.504	40.542	40.580	40.618	40.655	40.693	40.731	40.769	40.807	40.845	1110
1710	33.627	33.649	33.671	33.693	33.715	33.737	33.759	33.781	33.803	33.825	33.847	1720	1110	40.466	40.504	40.542	40.580	40.618	40.655	40.693	40.731	40.769	40.807	40.845	1110	1720	33.844	33.866	33.888	33.910	33.932	33.954	33.976	34.000	34.022	34.044	34.066	1720	1120	40.845	40.883	40.920	40.958	40.996	41.034	41.072	41.109	41.147	41.185	41.223	1120
1720	33.844	33.866	33.888	33.910	33.932	33.954	33.976	34.000	34.022	34.044	34.066	1730	1120	40.845	40.883	40.920	40.958	40.996	41.034	41.072	41.109	41.147	41.185	41.223	1120	1730	34.060	34.082	34.104	34.126	34.148	34.170	34.192	34.214	34.236	34.258	34.280	1730	1130	41.223	41.260	41.298	41.336	41.374	41.411	41.449	41.487	41.525	41.562	41.600	1130
1730	34.060	34.082	34.104	34.126	34.148	34.170	34.192	34.214	34.236	34.258	34.280	1740	1130	41.223	41.260	41.298	41.336	41.374	41.411	41.449	41.487	41.525	41.562	41.600	1130	1740	34.276	34.298	34.320	34.342	34.364	34.386	34.408	34.430	34.452	34.474	34.496	1740	1140	41.600	41.638	41.675	41.713	41.751	41.788	41.826	41.864	41.901	41.939	41.976	1140
1740	34.276	34.298	34.320	34.342	34.364	34.386	34.408	34.430	34.452	34.474	34.496	1750	1140	41.600	41.638	41.675	41.713	41.751	41.788	41.826	41.864	41.901	41.939	41.976	1140	1750	34.491	34.513	34.535	34.557	34.579	34.601	34.623	34.645	34.667	34.689	34.711	1750	1150	41.976	42.014	42.052	42.090	42.127	42.164	42.202	42.239	42.277	42.314	42.352	1150
1750	34.491	34.513	34.535	34.557	34.579	34.601	34.623	34.645	34.667	34.689	34.711	1760	1150	41.976	42.014	42.052	42.090	42.127	42.164	42.202	42.239	42.277	42.314	42.352	1150	1760	34.707	34.729	34.751	34.773	34.795	34.817	34.839	34.861	34.883	34.905	34.927	1760	1160	42.352	42.390	42.427	42.465	42.502	42.540	42.577	42.614	42.652	42.689	42.727	1160



2050 °F - 2372 °F

Type N - Nicrosil vs Nisil

1250 °C - 1300 °C

°F	0	1	2	3	4	5	6	7	8	9	10	°F	°C	0	1	2	3	4	5	6	7	8	9	10	°C
EMF in Millivolts — Reference Junction 32°F												EMF in Millivolts — Reference Junctions 0 °C													
2050	40.887	40.908	40.929	40.950	40.971	40.992	41.013	41.034	41.055	41.076	41.097	2050	1250	45.694	45.731	45.767	45.804	45.841	45.877	45.914	45.951	45.987	46.024	46.060	1250
2060	41.097	41.118	41.139	41.160	41.181	41.202	41.223	41.244	41.265	41.286	41.307	2060	1260	46.060	46.097	46.133	46.170	46.207	46.243	46.280	46.316	46.353	46.389	46.425	1260
2070	41.307	41.328	41.349	41.370	41.390	41.411	41.432	41.453	41.474	41.495	41.516	2070	1270	46.425	46.462	46.498	46.535	46.571	46.608	46.644	46.680	46.717	46.753	46.789	1270
2080	41.516	41.537	41.558	41.579	41.600	41.621	41.642	41.663	41.684	41.705	41.725	2080	1280	46.789	46.826	46.862	46.898	46.935	46.971	47.007	47.043	47.079	47.116	47.152	1280
2090	41.725	41.746	41.767	41.788	41.809	41.830	41.851	41.872	41.893	41.914	41.935	2090	1290	47.152	47.188	47.224	47.260	47.296	47.333	47.369	47.405	47.441	47.477	47.513	1290
2100	41.935	41.955	41.976	41.997	42.018	42.039	42.060	42.081	42.102	42.123	42.143	2100	1300	47.513											1300
2110	42.143	42.164	42.185	42.206	42.227	42.248	42.269	42.289	42.310	42.331	42.352														
2120	42.352	42.373	42.394	42.415	42.435	42.456	42.477	42.498	42.519	42.540	42.560														
2130	42.560	42.581	42.602	42.623	42.644	42.664	42.685	42.706	42.727	42.748	42.768														
2140	42.768	42.789	42.810	42.831	42.852	42.872	42.893	42.914	42.935	42.956	42.976														
2150	42.976	42.997	43.018	43.039	43.059	43.080	43.101	43.122	43.142	43.163	43.184	2150													
2160	43.184	43.205	43.225	43.246	43.267	43.288	43.308	43.329	43.350	43.370	43.391	2160													
2170	43.391	43.412	43.433	43.453	43.474	43.495	43.515	43.536	43.557	43.578	43.598	2170													
2180	43.598	43.619	43.640	43.660	43.681	43.702	43.722	43.743	43.764	43.784	43.805	2180													
2190	43.805	43.826	43.846	43.867	43.888	43.908	43.929	43.950	43.970	43.991	44.012	2190													
2200	44.012	44.032	44.053	44.073	44.094	44.115	44.135	44.156	44.177	44.197	44.218	2200													
2210	44.218	44.238	44.259	44.280	44.300	44.321	44.341	44.362	44.383	44.403	44.424	2210													
2220	44.424	44.444	44.465	44.485	44.506	44.527	44.547	44.568	44.588	44.609	44.629	2220													
2230	44.629	44.650	44.671	44.691	44.712	44.732	44.753	44.773	44.794	44.814	44.835	2230													
2240	44.835	44.855	44.876	44.896	44.917	44.937	44.958	44.978	44.999	45.019	45.040	2240													
2250	45.040	45.060	45.081	45.101	45.122	45.142	45.163	45.183	45.204	45.224	45.245	2250													
2260	45.245	45.265	45.286	45.306	45.326	45.347	45.367	45.388	45.408	45.429	45.449	2260													
2270	45.449	45.469	45.490	45.510	45.531	45.551	45.572	45.592	45.612	45.633	45.653	2270													
2280	45.653	45.674	45.694	45.714	45.735	45.755	45.775	45.796	45.816	45.837	45.857	2280													
2290	45.857	45.877	45.898	45.918	45.938	45.959	45.979	45.999	46.020	46.040	46.060	2290													
2300	46.060	46.081	46.101	46.121	46.142	46.162	46.182	46.202	46.223	46.243	46.263	2300													
2310	46.263	46.284	46.304	46.324	46.344	46.365	46.385	46.405	46.425	46.446	46.466	2310													
2320	46.466	46.486	46.506	46.527	46.547	46.567	46.587	46.608	46.628	46.648	46.668	2320													
2330	46.668	46.688	46.709	46.729	46.749	46.769	46.789	46.810	46.830	46.850	46.870	2330													
2340	46.870	46.890	46.910	46.931	46.951	46.971	46.991	47.011	47.031	47.051	47.071	2340													
2350	47.071	47.092	47.112	47.132	47.152	47.172	47.192	47.212	47.232	47.252	47.272	2350													
2360	47.272	47.292	47.312	47.333	47.353	47.373	47.393	47.413	47.433	47.453	47.473	2360													
2370	47.473	47.493	47.513									2370													

N





44

°F												°C													
0	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9	10				
EMF in Millivolts — Reference Junction 32°F												EMF in Millivolts — Reference Junctions 0 °C													
950	4.580	4.586	4.593	4.599	4.605	4.611	4.617	4.623	4.629	4.635	4.641	950	550	5.021	5.033	5.044	5.055	5.066	5.077	5.088	5.099	5.111	5.122	5.133	550
960	4.641	4.647	4.653	4.659	4.666	4.672	4.678	4.684	4.690	4.696	4.702	960	560	5.133	5.144	5.155	5.166	5.178	5.189	5.200	5.211	5.222	5.234	5.245	560
970	4.702	4.708	4.714	4.720	4.727	4.733	4.739	4.745	4.751	4.757	4.763	970	570	5.245	5.256	5.267	5.279	5.290	5.301	5.312	5.323	5.335	5.346	5.357	570
980	4.763	4.769	4.775	4.782	4.788	4.794	4.800	4.806	4.812	4.818	4.824	980	580	5.357	5.369	5.380	5.391	5.402	5.414	5.425	5.436	5.448	5.459	5.470	580
990	4.824	4.831	4.837	4.843	4.849	4.855	4.861	4.867	4.874	4.880	4.886	990	590	5.470	5.481	5.493	5.504	5.515	5.527	5.538	5.549	5.561	5.572	5.583	590
1000	4.886	4.892	4.898	4.904	4.910	4.917	4.923	4.929	4.935	4.941	4.947	1000	600	5.583	5.595	5.606	5.618	5.629	5.640	5.652	5.663	5.674	5.686	5.697	600
1010	4.947	4.954	4.960	4.966	4.972	4.978	4.984	4.991	4.997	5.003	5.009	1010	610	5.697	5.709	5.720	5.731	5.743	5.754	5.766	5.777	5.789	5.800	5.812	610
1020	5.009	5.015	5.021	5.028	5.034	5.040	5.046	5.052	5.059	5.065	5.071	1020	620	5.812	5.823	5.834	5.846	5.857	5.869	5.880	5.892	5.903	5.915	5.926	620
1030	5.071	5.077	5.083	5.090	5.096	5.102	5.108	5.114	5.121	5.127	5.133	1030	630	5.926	5.938	5.949	5.961	5.972	5.984	5.995	6.007	6.018	6.030	6.041	630
1040	5.133	5.139	5.145	5.152	5.158	5.164	5.170	5.176	5.183	5.189	5.195	1040	640	6.041	6.053	6.065	6.076	6.088	6.099	6.111	6.122	6.134	6.146	6.157	640
1050	5.195	5.201	5.207	5.214	5.220	5.226	5.232	5.239	5.245	5.251	5.257	1050	650	6.157	6.169	6.180	6.192	6.204	6.215	6.227	6.238	6.250	6.262	6.273	650
1060	5.257	5.264	5.270	5.276	5.282	5.289	5.295	5.301	5.307	5.313	5.320	1060	660	6.273	6.285	6.297	6.308	6.320	6.332	6.343	6.355	6.367	6.378	6.390	660
1070	5.320	5.326	5.332	5.338	5.345	5.351	5.357	5.364	5.370	5.376	5.382	1070	670	6.390	6.402	6.413	6.425	6.437	6.448	6.460	6.472	6.484	6.495	6.507	670
1080	5.382	5.389	5.395	5.401	5.407	5.414	5.420	5.426	5.432	5.439	5.445	1080	680	6.507	6.519	6.531	6.542	6.554	6.566	6.578	6.589	6.601	6.613	6.625	680
1090	5.445	5.451	5.458	5.464	5.470	5.476	5.483	5.489	5.495	5.502	5.508	1090	690	6.625	6.636	6.648	6.660	6.672	6.684	6.695	6.707	6.719	6.731	6.743	690
1100	5.508	5.514	5.520	5.527	5.533	5.539	5.546	5.552	5.558	5.565	5.571	1100	700	6.743	6.755	6.766	6.778	6.790	6.802	6.814	6.826	6.838	6.849	6.861	700
1110	5.571	5.577	5.583	5.590	5.596	5.602	5.609	5.615	5.621	5.628	5.634	1110	710	6.861	6.873	6.885	6.897	6.909	6.921	6.933	6.945	6.956	6.968	6.980	710
1120	5.634	5.640	5.647	5.653	5.659	5.666	5.672	5.678	5.685	5.691	5.697	1120	720	6.980	6.992	7.004	7.016	7.028	7.040	7.052	7.064	7.076	7.088	7.100	720
1130	5.697	5.704	5.710	5.716	5.723	5.729	5.735	5.742	5.748	5.754	5.761	1130	730	7.100	7.112	7.124	7.136	7.148	7.160	7.172	7.184	7.196	7.208	7.220	730
1140	5.761	5.767	5.773	5.780	5.786	5.792	5.799	5.805	5.812	5.818	5.824	1140	740	7.220	7.232	7.244	7.256	7.268	7.280	7.292	7.304	7.316	7.328	7.340	740
1150	5.824	5.831	5.837	5.843	5.850	5.856	5.862	5.869	5.875	5.882	5.888	1150	750	7.340	7.352	7.364	7.376	7.389	7.401	7.413	7.425	7.437	7.449	7.461	750
1160	5.888	5.894	5.901	5.907	5.913	5.920	5.926	5.933	5.939	5.945	5.952	1160	760	7.461	7.473	7.485	7.498	7.510	7.522	7.534	7.546	7.558	7.570	7.583	760
1170	5.952	5.958	5.965	5.971	5.977	5.984	5.990	5.997	6.003	6.009	6.016	1170	770	7.583	7.595	7.607	7.619	7.631	7.644	7.656	7.668	7.680	7.692	7.705	770
1180	6.016	6.022	6.029	6.035	6.041	6.048	6.054	6.061	6.067	6.074	6.080	1180	780	7.705	7.717	7.729	7.741	7.753	7.766	7.778	7.790	7.802	7.815	7.827	780
1190	6.080	6.086	6.093	6.099	6.106	6.112	6.119	6.125	6.131	6.138	6.144	1190	790	7.827	7.839	7.851	7.864	7.876	7.888	7.901	7.913	7.925	7.938	7.950	790
1200	6.144	6.151	6.157	6.164	6.170	6.176	6.183	6.189	6.196	6.202	6.209	1200	800	7.950	7.962	7.974	7.987	7.999	8.011	8.024	8.036	8.048	8.061	8.073	800
1210	6.209	6.215	6.222	6.228	6.235	6.241	6.247	6.254	6.260	6.267	6.273	1210	810	8.073	8.086	8.098	8.110	8.123	8.135	8.147	8.160	8.172	8.185	8.197	810
1220	6.273	6.280	6.286	6.293	6.299	6.306	6.312	6.319	6.325	6.332	6.338	1220	820	8.197	8.209	8.222	8.234	8.247	8.259	8.272	8.284	8.296	8.309	8.321	820
1230	6.338	6.345	6.351	6.358	6.364	6.370	6.377	6.383	6.390	6.396	6.403	1230	830	8.321	8.334	8.346	8.359	8.371	8.384	8.396	8.409	8.421	8.434	8.446	830
1240	6.403	6.409	6.416	6.422	6.429	6.435	6.442	6.448	6.455	6.461	6.468	1240	840	8.446	8.459	8.471	8.484	8.496	8.509	8.521	8.534	8.546	8.559	8.571	840
1250	6.468	6.474	6.481	6.488	6.494	6.501	6.507	6.514	6.520	6.527	6.533	1250													
1260	6.533	6.540	6.546	6.553	6.559	6.566	6.572	6.579	6.585	6.592	6.598	1260													
1270	6.598	6.605	6.612	6.618	6.625	6.631	6.638	6.644	6.651	6.657	6.664	1270													
1280	6.664	6.671	6.677	6.684	6.690	6.697	6.703	6.710	6.716	6.723	6.730	1280													
1290	6.730	6.736	6.743	6.749	6.756	6.762	6.769	6.776	6.782	6.789	6.795	1290													
1300	6.795	6.802	6.809	6.815	6.822	6.828	6.835	6.841	6.848	6.855	6.861	1300													
1310	6.861	6.868	6.874	6.881	6.888	6.894	6.901	6.908	6.914	6.921	6.927	1310													
1320	6.927	6.934	6.941	6.947	6.954	6.960	6.967	6.974	6.980	6.987	6.994	1320													
1330	6.994	7.000	7.007	7.013	7.020	7.027	7.033	7.040	7.047	7.053	7.060	1330													
1340	7.060	7.067	7.073	7.080	7.086	7.093	7.100	7.106	7.113	7.120	7.126	1340													
1350	7.126	7.133	7.140	7.146	7.153	7.160	7.166	7.173	7.180	7.186	7.193	1350													
1360	7.193	7.200	7.206	7.213	7.220	7.226	7.233	7.240	7.247	7.253	7.260	1360													
1370	7.260	7.267	7.273	7.280	7.287	7.293	7.300	7.307	7.313	7.320	7.327	1370													
1380	7.327	7.334	7.340	7.347	7.354	7.360	7.367	7.374	7.381	7.387	7.394	1380													
1390	7.394	7.401	7.407	7.414	7.421	7.428	7.434	7.441	7.448	7.454	7.461	1390													
1400	7.461	7.468	7.475	7.481	7.488	7.495	7.502	7.508	7.515	7.522	7.529	1400													
1410	7.529	7.535	7.542	7.549	7.556	7.562	7.569	7.576	7.583	7.589	7.596	1410													
1420	7.596	7.603	7.610	7.616	7.623	7.630	7.637	7.644	7.650	7.657	7.664	1420													
1430	7.664	7.671	7.677	7.684	7.691	7.698	7.705	7.711	7.718	7.725	7.732	1430													
1440	7.732	7.739	7.745	7.752	7.759	7.766	7.772	7.779	7.786	7.793	7.800	1440													



1950 °F - 2450 °F

Type R - PT 13% RH vs Platinum

1150 °C - 1450 °C

°F	EMF in Millivolts — Reference Junction 32°F											°F	°C	EMF in Millivolts — Reference Junctions 0 °C											°C
	0	1	2	3	4	5	6	7	8	9	10			0	1	2	3	4	5	6	7	8	9	10	
1950	11.382	11.390	11.397	11.405	11.412	11.420	11.427	11.435	11.442	11.450	11.457	1950	1150	12.535	12.549	12.563	12.577	12.590	12.604	12.618	12.632	12.646	12.659	12.673	1150
1960	11.457	11.465	11.472	11.480	11.487	11.495	11.502	11.510	11.518	11.525	11.533	1960	1160	12.673	12.687	12.701	12.715	12.729	12.742	12.756	12.770	12.784	12.798	12.812	1160
1970	11.533	11.540	11.548	11.555	11.563	11.570	11.578	11.585	11.593	11.600	11.608	1970	1170	12.812	12.825	12.839	12.853	12.867	12.881	12.895	12.909	12.922	12.936	12.950	1170
1980	11.608	11.615	11.623	11.631	11.638	11.646	11.653	11.661	11.668	11.676	11.683	1980	1180	12.950	12.964	12.978	12.992	13.006	13.019	13.033	13.047	13.061	13.075	13.089	1180
1990	11.683	11.691	11.698	11.706	11.714	11.721	11.729	11.736	11.744	11.751	11.759	1990	1190	13.089	13.103	13.117	13.131	13.145	13.158	13.172	13.186	13.200	13.214	13.228	1190
2000	11.759	11.766	11.774	11.782	11.789	11.797	11.804	11.812	11.819	11.827	11.835	2000	1200	13.228	13.242	13.256	13.270	13.284	13.298	13.311	13.325	13.339	13.353	13.367	1200
2010	11.835	11.842	11.850	11.857	11.865	11.872	11.880	11.888	11.895	11.903	11.910	2010	1210	13.367	13.381	13.395	13.409	13.423	13.437	13.451	13.465	13.479	13.493	13.507	1210
2020	11.910	11.918	11.925	11.933	11.941	11.948	11.956	11.963	11.971	11.979	11.986	2020	1220	13.507	13.521	13.535	13.549	13.563	13.577	13.590	13.604	13.618	13.632	13.646	1220
2030	11.986	11.994	12.001	12.009	12.016	12.024	12.032	12.039	12.047	12.054	12.062	2030	1230	13.646	13.660	13.674	13.688	13.702	13.716	13.730	13.744	13.758	13.772	13.786	1230
2040	12.062	12.070	12.077	12.085	12.092	12.100	12.108	12.115	12.123	12.131	12.138	2040	1240	13.786	13.800	13.814	13.828	13.842	13.856	13.870	13.884	13.898	13.912	13.926	1240
2050	12.138	12.146	12.153	12.161	12.169	12.176	12.184	12.191	12.199	12.207	12.214	2050	1250	13.926	13.940	13.954	13.968	13.982	13.996	14.010	14.024	14.038	14.052	14.066	1250
2060	12.214	12.222	12.230	12.237	12.245	12.252	12.260	12.268	12.275	12.283	12.291	2060	1260	14.066	14.081	14.095	14.109	14.123	14.137	14.151	14.165	14.179	14.193	14.207	1260
2070	12.291	12.298	12.306	12.313	12.321	12.329	12.336	12.344	12.352	12.359	12.367	2070	1270	14.207	14.221	14.235	14.249	14.263	14.277	14.291	14.305	14.319	14.333	14.347	1270
2080	12.367	12.375	12.382	12.390	12.398	12.405	12.413	12.420	12.428	12.436	12.443	2080	1280	14.347	14.361	14.375	14.390	14.404	14.418	14.432	14.446	14.460	14.474	14.488	1280
2090	12.443	12.451	12.459	12.466	12.474	12.482	12.489	12.497	12.505	12.512	12.520	2090	1290	14.488	14.502	14.516	14.530	14.544	14.558	14.572	14.586	14.601	14.615	14.629	1290
2100	12.520	12.528	12.535	12.543	12.551	12.558	12.566	12.574	12.581	12.589	12.597	2100	1300	14.629	14.643	14.657	14.671	14.685	14.699	14.713	14.727	14.741	14.755	14.770	1300
2110	12.597	12.604	12.612	12.620	12.627	12.635	12.643	12.650	12.658	12.666	12.673	2110	1310	14.770	14.784	14.798	14.812	14.826	14.840	14.854	14.868	14.882	14.896	14.911	1310
2120	12.673	12.681	12.689	12.696	12.704	12.712	12.719	12.727	12.735	12.742	12.750	2120	1320	14.911	14.925	14.939	14.953	14.967	14.981	14.995	15.009	15.023	15.037	15.052	1320
2130	12.750	12.758	12.765	12.773	12.781	12.788	12.796	12.804	12.812	12.819	12.827	2130	1330	15.052	15.066	15.080	15.094	15.108	15.122	15.136	15.150	15.164	15.179	15.193	1330
2140	12.827	12.835	12.842	12.850	12.858	12.865	12.873	12.881	12.889	12.896	12.904	2140	1340	15.193	15.207	15.221	15.235	15.249	15.263	15.277	15.291	15.306	15.320	15.334	1340
2150	12.904	12.912	12.919	12.927	12.935	12.942	12.950	12.958	12.966	12.973	12.981	2150	1350	15.334	15.348	15.362	15.376	15.390	15.404	15.419	15.433	15.447	15.461	15.475	1350
2160	12.981	12.989	12.996	13.004	13.012	13.019	13.027	13.035	13.043	13.050	13.058	2160	1360	15.475	15.489	15.503	15.517	15.531	15.546	15.560	15.574	15.588	15.602	15.616	1360
2170	13.058	13.066	13.073	13.081	13.089	13.097	13.104	13.112	13.120	13.128	13.135	2170	1370	15.616	15.630	15.645	15.659	15.673	15.687	15.701	15.715	15.729	15.743	15.758	1370
2180	13.135	13.143	13.151	13.158	13.166	13.174	13.182	13.189	13.197	13.205	13.213	2180	1380	15.758	15.772	15.786	15.800	15.814	15.828	15.842	15.856	15.871	15.885	15.899	1380
2190	13.213	13.220	13.228	13.236	13.243	13.251	13.259	13.267	13.274	13.282	13.290	2190	1390	15.899	15.913	15.927	15.941	15.955	15.969	15.984	15.998	16.012	16.026	16.040	1390
2200	13.290	13.298	13.305	13.313	13.321	13.329	13.336	13.344	13.352	13.359	13.367	2200	1400	16.040	16.054	16.068	16.082	16.097	16.111	16.125	16.139	16.153	16.167	16.181	1400
2210	13.367	13.375	13.383	13.390	13.398	13.406	13.414	13.421	13.429	13.437	13.445	2210	1410	16.181	16.196	16.210	16.224	16.238	16.252	16.266	16.280	16.294	16.309	16.323	1410
2220	13.445	13.452	13.460	13.468	13.476	13.483	13.491	13.499	13.507	13.514	13.522	2220	1420	16.323	16.337	16.351	16.365	16.379	16.393	16.407	16.422	16.436	16.450	16.464	1420
2230	13.522	13.530	13.538	13.545	13.553	13.561	13.569	13.577	13.584	13.592	13.600	2230	1430	16.464	16.478	16.492	16.506	16.520	16.534	16.549	16.563	16.577	16.591	16.605	1430
2240	13.600	13.608	13.615	13.623	13.631	13.639	13.646	13.654	13.662	13.670	13.677	2240	1440	16.605	16.619	16.633	16.647	16.662	16.676	16.690	16.704	16.718	16.732	16.746	1440
2250	13.677	13.685	13.693	13.701	13.709	13.716	13.724	13.732	13.740	13.747	13.755	2250													
2260	13.755	13.763	13.771	13.778	13.786	13.794	13.802	13.810	13.817	13.825	13.833	2260													
2270	13.833	13.841	13.848	13.856	13.864	13.872	13.880	13.888	13.895	13.903	13.911	2270													
2280	13.911	13.919	13.926	13.934	13.942	13.950	13.957	13.965	13.973	13.981	13.989	2280													
2290	13.989	13.996	14.004	14.012	14.020	14.028	14.035	14.043	14.051	14.059	14.066	2290													
2300	14.066	14.074	14.082	14.090	14.098	14.105	14.113	14.121	14.129	14.137	14.144	2300													
2310	14.144	14.152	14.160	14.168	14.176	14.183	14.191	14.199	14.207	14.215	14.222	2310													
2320	14.222	14.230	14.238	14.246	14.254	14.261	14.269	14.277	14.285	14.293	14.300	2320													
2330	14.300	14.308	14.316	14.324	14.332	14.340	14.347	14.355	14.363	14.371	14.379	2330													
2340	14.379	14.386	14.394	14.402	14.410	14.418	14.425	14.433	14.441	14.449	14.457	2340													
2350	14.457	14.465	14.472	14.480	14.488	14.496	14.504	14.511	14.519	14.527	14.535	2350													
2360	14.535	14.543	14.551	14.558	14.566	14.574	14.582	14.590	14.597	14.605	14.613	2360													
2370	14.613	14.621	14.629	14.637	14.644	14.652	14.660	14.668	14.676	14.683	14.691	2370													
2380	14.691	14.699	14.707	14.715	14.723	14.730	14.738	14.746	14.754	14.762	14.770	2380													
2390	14.770	14.777	14.785	14.793	14.801	14.809	14.817	14.824	14.832	14.840	14.848	2390													
2400	14.848	14.856	14.864	14.871	14.879	14.887	14.895	14.903	14.911	14.918	14.926	2400													
2410	14.926	14.934	14.942	14.950	14.958	14.965	14.973	14.981	14.989	14.997	15.005	2410													
2420	15.005	15.012	15.020	15.028	15.036	15.044	15.052	15.059	15.067	15.075	15.083														

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°F	0	1	2	3	4	5	6	7	8	9	10	°F	°C	0	1	2	3	4	5	6	7	8	9	10	°C
<b>EMF in Millivolts — Reference Junction 32°F</b>												<b>EMF in Millivolts — Reference Junctions 0 °C</b>													
2450	15.240	15.248	15.255	15.263	15.271	15.279	15.287	15.295	15.302	15.310	15.318	2450	1450	16.746	16.760	16.774	16.789	16.803	16.817	16.831	16.845	16.859	16.873	16.887	1450
2460	15.318	15.326	15.334	15.342	15.349	15.357	15.365	15.373	15.381	15.389	15.397	2460	1460	16.887	16.901	16.915	16.930	16.944	16.958	16.972	16.986	17.000	17.014	17.028	1460
2470	15.397	15.404	15.412	15.420	15.428	15.436	15.444	15.451	15.459	15.467	15.475	2470	1470	17.028	17.042	17.056	17.071	17.085	17.099	17.113	17.127	17.141	17.155	17.169	1470
2480	15.475	15.483	15.491	15.499	15.506	15.514	15.522	15.530	15.538	15.546	15.553	2480	1480	17.169	17.183	17.197	17.211	17.225	17.240	17.254	17.268	17.282	17.296	17.310	1480
2490	15.553	15.561	15.569	15.577	15.585	15.593	15.601	15.608	15.616	15.624	15.632	2490	1490	17.310	17.324	17.338	17.352	17.366	17.380	17.394	17.408	17.423	17.437	17.451	1490
2500	15.632	15.640	15.648	15.655	15.663	15.671	15.679	15.687	15.695	15.703	15.710	2500	1500	17.451	17.465	17.479	17.493	17.507	17.521	17.535	17.549	17.563	17.577	17.591	1500
2510	15.710	15.718	15.726	15.734	15.742	15.750	15.758	15.765	15.773	15.781	15.789	2510	1510	17.591	17.605	17.619	17.633	17.647	17.661	17.676	17.690	17.704	17.718	17.732	1510
2520	15.789	15.797	15.805	15.812	15.820	15.828	15.836	15.844	15.852	15.860	15.867	2520	1520	17.732	17.746	17.760	17.774	17.788	17.802	17.816	17.830	17.844	17.858	17.872	1520
2530	15.867	15.875	15.883	15.891	15.899	15.907	15.915	15.922	15.930	15.938	15.946	2530	1530	17.872	17.886	17.900	17.914	17.928	17.942	17.956	17.970	17.984	17.998	18.012	1530
2540	15.946	15.954	15.962	15.969	15.977	15.985	15.993	16.001	16.009	16.017	16.024	2540	1540	18.012	18.026	18.040	18.054	18.068	18.082	18.096	18.110	18.124	18.138	18.152	1540
2550	16.024	16.032	16.040	16.048	16.056	16.064	16.071	16.079	16.087	16.095	16.103	2550	1550	18.152	18.166	18.180	18.194	18.208	18.222	18.236	18.250	18.264	18.278	18.292	1550
2560	16.103	16.111	16.119	16.126	16.134	16.142	16.150	16.158	16.166	16.174	16.181	2560	1560	18.292	18.306	18.320	18.334	18.348	18.362	18.376	18.390	18.404	18.417	18.431	1560
2570	16.181	16.189	16.197	16.205	16.213	16.221	16.228	16.236	16.244	16.252	16.260	2570	1570	18.431	18.445	18.459	18.473	18.487	18.501	18.515	18.529	18.543	18.557	18.571	1570
2580	16.260	16.268	16.276	16.283	16.291	16.299	16.307	16.315	16.323	16.330	16.338	2580	1580	18.571	18.585	18.599	18.613	18.627	18.640	18.654	18.668	18.682	18.696	18.710	1580
2590	16.338	16.346	16.354	16.362	16.370	16.378	16.385	16.393	16.401	16.409	16.417	2590	1590	18.710	18.724	18.738	18.752	18.766	18.779	18.793	18.807	18.821	18.835	18.849	1590
2600	16.417	16.425	16.432	16.440	16.448	16.456	16.464	16.472	16.480	16.487	16.495	2600	1600	18.849	18.863	18.877	18.891	18.904	18.918	18.932	18.946	18.960	18.974	18.988	1600
2610	16.495	16.503	16.511	16.519	16.527	16.534	16.542	16.550	16.558	16.566	16.574	2610	1610	18.988	19.002	19.015	19.029	19.043	19.057	19.071	19.085	19.098	19.112	19.126	1610
2620	16.574	16.582	16.589	16.597	16.605	16.613	16.621	16.629	16.636	16.644	16.652	2620	1620	19.126	19.140	19.154	19.168	19.181	19.195	19.209	19.223	19.237	19.250	19.264	1620
2630	16.652	16.660	16.668	16.676	16.683	16.691	16.699	16.707	16.715	16.723	16.731	2630	1630	19.264	19.278	19.292	19.306	19.319	19.333	19.347	19.361	19.375	19.388	19.402	1630
2640	16.731	16.738	16.746	16.754	16.762	16.770	16.778	16.785	16.793	16.801	16.809	2640	1640	19.402	19.416	19.430	19.444	19.457	19.471	19.485	19.499	19.512	19.526	19.540	1640
2650	16.809	16.817	16.825	16.832	16.840	16.848	16.856	16.864	16.872	16.879	16.887	2650	1650	19.540	19.554	19.567	19.581	19.595	19.609	19.622	19.636	19.650	19.663	19.677	1650
2660	16.887	16.895	16.903	16.911	16.919	16.926	16.934	16.942	16.950	16.958	16.966	2660	1660	19.677	19.691	19.705	19.718	19.732	19.746	19.759	19.773	19.787	19.800	19.814	1660
2670	16.966	16.973	16.981	16.989	16.997	17.005	17.013	17.020	17.028	17.036	17.044	2670	1670	19.814	19.828	19.841	19.855	19.869	19.882	19.896	19.910	19.923	19.937	19.951	1670
2680	17.044	17.052	17.060	17.067	17.075	17.083	17.091	17.099	17.107	17.114	17.122	2680	1680	19.951	19.964	19.978	19.992	20.005	20.019	20.032	20.046	20.060	20.073	20.087	1680
2690	17.122	17.130	17.138	17.146	17.154	17.161	17.169	17.177	17.185	17.193	17.200	2690	1690	20.087	20.100	20.114	20.127	20.141	20.154	20.168	20.181	20.195	20.208	20.222	1690
2700	17.200	17.208	17.216	17.224	17.232	17.240	17.247	17.255	17.263	17.271	17.279	2700	1700	20.222	20.235	20.249	20.262	20.275	20.289	20.302	20.316	20.329	20.342	20.356	1700
2710	17.279	17.286	17.294	17.302	17.310	17.318	17.326	17.333	17.341	17.349	17.357	2710	1710	20.356	20.369	20.382	20.396	20.409	20.422	20.436	20.449	20.462	20.475	20.488	1710
2720	17.357	17.365	17.373	17.380	17.388	17.396	17.404	17.412	17.419	17.427	17.435	2720	1720	20.488	20.502	20.515	20.528	20.541	20.554	20.567	20.581	20.594	20.607	20.620	1720
2730	17.435	17.443	17.451	17.458	17.466	17.474	17.482	17.490	17.498	17.505	17.513	2730	1730	20.620	20.633	20.646	20.659	20.672	20.685	20.698	20.711	20.724	20.736	20.749	1730
2740	17.513	17.521	17.529	17.537	17.544	17.552	17.560	17.568	17.576	17.583	17.591	2740	1740	20.749	20.762	20.775	20.788	20.801	20.813	20.826	20.839	20.852	20.864	20.877	1740
2750	17.591	17.599	17.607	17.615	17.622	17.630	17.638	17.646	17.654	17.661	17.669	2750	1750												
2760	17.669	17.677	17.685	17.693	17.700	17.708	17.716	17.724	17.732	17.739	17.747	2760	1760												
2770	17.747	17.755	17.763	17.771	17.778	17.786	17.794	17.802	17.810	17.817	17.825	2770	1770												
2780	17.825	17.833	17.841	17.849	17.856	17.864	17.872	17.880	17.888	17.895	17.903	2780	1780												
2790	17.903	17.911	17.919	17.926	17.934	17.942	17.950	17.958	17.965	17.973	17.981	2790	1790												
2800	17.981	17.989	17.997	18.004	18.012	18.020	18.028	18.035	18.043	18.051	18.059	2800	1800												
2810	18.059	18.067	18.074	18.082	18.090	18.098	18.105	18.113	18.121	18.129	18.137	2810	1810												
2820	18.137	18.144	18.152	18.160	18.168	18.175	18.183	18.191	18.199	18.206	18.214	2820	1820												
2830	18.214	18.222	18.230	18.238	18.245	18.253	18.261	18.269	18.276	18.284	18.292	2830	1830												
2840	18.292	18.300	18.307	18.315	18.323	18.331	18.338	18.346	18.354	18.362	18.369	2840	1840												
2850	18.369	18.377	18.385	18.393	18.400	18.408	18.416	18.424	18.431	18.439	18.447	2850	1850												
2860	18.447	18.455	18.462	18.470	18.478	18.486	18.493	18.501	18.509	18.517	18.524	2860	1860												
2870	18.524	18.532	18.540	18.548	18.555	18.563	18.571	18.579	18.586	18.594	18.602	2870	1870												
2880	18.602	18.610	18.617	18.625	18.633	18.640	18.648	18.656	18.664	18.671	18.679	2880	1880												
2890	18.679	18.687	18.695	18.702	18.710	18.718	18.725	18.733	18.741	18.749	18.756	2890	1890												
2900	18.756	18.764	18.772	18.779	18.787	18.795	18.803	18.810	18.818	18.826	18.834	2900	1900												
2910	18.834	18.841	18.849	18.857	18.864	18.872	18.880	18.887	18.895	18.903	18.911	2910													

2950 °F - 3214 °F

Type R - PT 13% RH vs Platinum

1750 °C - 1768 °C

°F											°C														
0	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9	10				
EMF in Millivolts — Reference Junction 32°F											EMF in Millivolts — Reference Junctions 0 °C														
<b>2950</b>	19.141	19.149	19.157	19.165	19.172	19.180	19.188	19.195	19.203	19.211	19.218	<b>2950</b>	<b>1750</b>	20.877	20.890	20.902	20.915	20.928	20.940	20.953	20.965	20.978	20.990	21.003	<b>1750</b>
2960	19.218	19.226	19.234	19.241	19.249	19.257	19.264	19.272	19.280	19.287	19.295	2960	1760	21.003	21.015	21.027	21.040	21.052	21.065	21.077	21.089	21.101			1760
2970	19.295	19.303	19.310	19.318	19.326	19.333	19.341	19.349	19.356	19.364	19.372														
2980	19.372	19.379	19.387	19.395	19.402	19.410	19.418	19.425	19.433	19.440	19.448														
2990	19.448	19.456	19.463	19.471	19.479	19.486	19.494	19.502	19.509	19.517	19.525														
<b>3000</b>	19.525	19.532	19.540	19.547	19.555	19.563	19.570	19.578	19.586	19.593	19.601	<b>3000</b>													
3010	19.601	19.609	19.616	19.624	19.631	19.639	19.647	19.654	19.662	19.670	19.677	3010													
3020	19.677	19.685	19.692	19.700	19.708	19.715	19.723	19.730	19.738	19.746	19.753	3020													
3030	19.753	19.761	19.769	19.776	19.784	19.791	19.799	19.807	19.814	19.822	19.829	3030													
3040	19.829	19.837	19.845	19.852	19.860	19.867	19.875	19.882	19.890	19.898	19.905	3040													
<b>3050</b>	19.905	19.913	19.920	19.928	19.936	19.943	19.951	19.958	19.966	19.973	19.981	<b>3050</b>													
3060	19.981	19.989	19.996	20.004	20.011	20.019	20.026	20.034	20.041	20.049	20.056	3060													
3070	20.056	20.064	20.072	20.079	20.087	20.094	20.102	20.109	20.117	20.124	20.132	3070													
3080	20.132	20.139	20.147	20.154	20.162	20.169	20.177	20.184	20.192	20.199	20.207	3080													
3090	20.207	20.214	20.222	20.229	20.237	20.244	20.252	20.259	20.266	20.274	20.281	3090													
<b>3100</b>	20.281	20.289	20.296	20.304	20.311	20.319	20.326	20.333	20.341	20.348	20.356	<b>3100</b>													
3110	20.356	20.363	20.371	20.378	20.385	20.393	20.400	20.407	20.415	20.422	20.430	3110													
3120	20.430	20.437	20.444	20.452	20.459	20.466	20.474	20.481	20.488	20.496	20.503	3120													
3130	20.503	20.510	20.518	20.525	20.532	20.540	20.547	20.554	20.562	20.569	20.576	3130													
3140	20.576	20.583	20.591	20.598	20.605	20.612	20.620	20.627	20.634	20.641	20.649	3140													
<b>3150</b>	20.649	20.656	20.663	20.670	20.678	20.685	20.692	20.699	20.706	20.714	20.721	<b>3150</b>													
3160	20.721	20.728	20.735	20.742	20.749	20.756	20.764	20.771	20.778	20.785	20.792	3160													
3170	20.792	20.799	20.806	20.813	20.821	20.828	20.835	20.842	20.849	20.856	20.863	3170													
3180	20.863	20.870	20.877	20.884	20.891	20.898	20.905	20.912	20.919	20.926	20.933	3180													
3190	20.933	20.940	20.947	20.954	20.961	20.968	20.975	20.982	20.989	20.996	21.003	3190													
<b>3200</b>	21.003	21.010	21.016	21.023	21.030	21.037	21.044	21.051	21.058	21.065	21.071	<b>3200</b>													
3210	21.071	21.078	21.085	21.092	21.099							3210													

R

48



-58 °F - 450 °F

Type S - PT 10% RH vs Platinum

-50 °C - 250 °C

**EMF in Millivolts — Reference Junction 32°F**

°F	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	°F
-50	-0.218	-0.220	-0.222	-0.224	-0.227	-0.229	-0.231	-0.233	-0.236	-0.215	-0.218	-50
-40	-0.194	-0.197	-0.199	-0.201	-0.204	-0.206	-0.208	-0.211	-0.213	-0.192	-0.194	-40
-30	-0.170	-0.173	-0.175	-0.178	-0.180	-0.182	-0.185	-0.187	-0.190	-0.168	-0.170	-30
-20	-0.145	-0.148	-0.150	-0.153	-0.155	-0.158	-0.160	-0.163	-0.165	-0.142	-0.145	-20
-10	-0.119	-0.122	-0.124	-0.127	-0.129	-0.132	-0.135	-0.137	-0.140	-0.116	-0.119	-10
0	-0.092	-0.095	-0.097	-0.100	-0.103	-0.106	-0.108	-0.111	-0.114	-0.091	-0.094	0
10	-0.064	-0.061	-0.058	-0.054	-0.053	-0.050	-0.047	-0.044	-0.041	-0.019	-0.022	10
20	-0.035	-0.033	-0.030	-0.027	-0.024	-0.021	-0.018	-0.015	-0.012	0.009	0.012	20
30	-0.006	-0.003	0.000	0.003	0.006	0.009	0.012	0.015	0.018	0.021	0.024	30
40	0.024	0.027	0.030	0.033	0.037	0.040	0.043	0.046	0.049	0.052	0.055	40
50	0.055	0.058	0.062	0.065	0.068	0.071	0.074	0.077	0.081	0.084	0.087	50
60	0.087	0.090	0.093	0.097	0.100	0.103	0.106	0.110	0.113	0.116	0.119	60
70	0.119	0.123	0.126	0.129	0.133	0.136	0.139	0.143	0.146	0.149	0.153	70
80	0.153	0.156	0.159	0.163	0.166	0.169	0.173	0.176	0.180	0.183	0.186	80
90	0.186	0.190	0.193	0.197	0.200	0.204	0.207	0.210	0.214	0.217	0.221	90
100	0.221	0.224	0.228	0.231	0.235	0.238	0.242	0.245	0.249	0.252	0.256	100
110	0.256	0.260	0.263	0.267	0.270	0.274	0.277	0.281	0.285	0.288	0.292	110
120	0.292	0.295	0.299	0.303	0.306	0.310	0.313	0.317	0.321	0.324	0.328	120
130	0.328	0.332	0.335	0.339	0.343	0.346	0.350	0.354	0.357	0.361	0.365	130
140	0.365	0.369	0.372	0.376	0.380	0.384	0.387	0.391	0.395	0.399	0.402	140
150	0.402	0.406	0.410	0.414	0.417	0.421	0.425	0.429	0.433	0.436	0.440	150
160	0.440	0.444	0.448	0.452	0.456	0.459	0.463	0.467	0.471	0.475	0.479	160
170	0.479	0.483	0.487	0.490	0.494	0.498	0.502	0.506	0.510	0.514	0.518	170
180	0.518	0.522	0.526	0.530	0.534	0.538	0.541	0.545	0.549	0.553	0.557	180
190	0.557	0.561	0.565	0.569	0.573	0.577	0.581	0.585	0.589	0.593	0.597	190
200	0.597	0.601	0.605	0.609	0.613	0.617	0.622	0.626	0.630	0.634	0.638	200
210	0.638	0.642	0.646	0.650	0.654	0.658	0.662	0.666	0.670	0.675	0.679	210
220	0.679	0.683	0.687	0.691	0.695	0.699	0.703	0.708	0.712	0.716	0.720	220
230	0.720	0.724	0.728	0.732	0.737	0.741	0.745	0.749	0.753	0.758	0.762	230
240	0.762	0.766	0.770	0.774	0.779	0.783	0.787	0.791	0.795	0.800	0.804	240
250	0.804	0.808	0.812	0.817	0.821	0.825	0.829	0.834	0.838	0.842	0.847	250
260	0.847	0.851	0.855	0.859	0.864	0.868	0.872	0.877	0.881	0.885	0.889	260
270	0.889	0.894	0.898	0.902	0.907	0.911	0.915	0.920	0.924	0.928	0.933	270
280	0.933	0.937	0.942	0.946	0.950	0.955	0.959	0.963	0.968	0.972	0.977	280
290	0.977	0.981	0.985	0.990	0.994	0.998	1.003	1.007	1.012	1.016	1.021	290
300	1.021	1.025	1.029	1.034	1.038	1.043	1.047	1.052	1.056	1.061	1.065	300
310	1.065	1.069	1.074	1.078	1.083	1.087	1.092	1.096	1.101	1.105	1.110	310
320	1.110	1.114	1.119	1.123	1.128	1.132	1.137	1.141	1.146	1.150	1.155	320
330	1.155	1.159	1.164	1.168	1.173	1.177	1.182	1.186	1.191	1.196	1.200	330
340	1.200	1.205	1.209	1.214	1.218	1.223	1.227	1.232	1.237	1.241	1.246	340
350	1.246	1.250	1.255	1.260	1.264	1.269	1.273	1.278	1.283	1.287	1.292	350
360	1.292	1.296	1.301	1.306	1.310	1.315	1.319	1.324	1.329	1.333	1.338	360
370	1.338	1.343	1.347	1.352	1.357	1.361	1.366	1.371	1.375	1.380	1.385	370
380	1.385	1.389	1.394	1.399	1.403	1.408	1.413	1.417	1.422	1.427	1.431	380
390	1.431	1.436	1.441	1.445	1.450	1.455	1.460	1.464	1.469	1.474	1.478	390
400	1.478	1.483	1.488	1.493	1.497	1.502	1.507	1.512	1.516	1.521	1.526	400
410	1.526	1.531	1.535	1.540	1.545	1.550	1.554	1.559	1.564	1.569	1.573	410
420	1.573	1.578	1.583	1.588	1.592	1.597	1.602	1.607	1.612	1.616	1.621	420
430	1.621	1.626	1.631	1.636	1.640	1.645	1.650	1.655	1.660	1.664	1.669	430
440	1.669	1.674	1.679	1.684	1.689	1.693	1.698	1.703	1.708	1.713	1.718	440

**EMF in Millivolts — Reference Junctions 0 °C**

°C	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	°C
-50	-0.236	-0.199	-0.203	-0.207	-0.211	-0.215	-0.219	-0.224	-0.228	-0.232	-0.236	-50
40	-0.194	-0.199	-0.203	-0.207	-0.211	-0.215	-0.219	-0.224	-0.228	-0.232	-0.236	40
-30	-0.150	-0.155	-0.159	-0.164	-0.168	-0.173	-0.177	-0.181	-0.186	-0.190	-0.194	-30
-20	-0.103	-0.108	-0.113	-0.117	-0.122	-0.127	-0.132	-0.136	-0.141	-0.146	-0.150	-20
-10	-0.053	-0.058	-0.063	-0.068	-0.073	-0.078	-0.083	-0.088	-0.093	-0.098	-0.103	-10
0	0.000	-0.005	-0.011	-0.016	-0.021	-0.027	-0.032	-0.037	-0.042	-0.048	-0.053	0
10	0.055	0.061	0.067	0.072	0.078	0.084	0.090	0.095	0.101	0.107	0.113	10
20	0.113	0.119	0.125	0.131	0.137	0.143	0.149	0.155	0.161	0.167	0.173	20
30	0.173	0.179	0.185	0.191	0.197	0.204	0.210	0.216	0.222	0.229	0.235	30
40	0.235	0.241	0.248	0.254	0.260	0.267	0.273	0.280	0.286	0.292	0.299	40
50	0.299	0.305	0.312	0.319	0.325	0.332	0.338	0.345	0.352	0.358	0.365	50
60	0.365	0.372	0.378	0.385	0.392	0.399	0.405	0.412	0.419	0.426	0.433	60
70	0.433	0.440	0.446	0.453	0.460	0.467	0.474	0.481	0.488	0.495	0.502	70
80	0.502	0.509	0.516	0.523	0.530	0.538	0.545	0.552	0.559	0.566	0.573	80
90	0.573	0.580	0.588	0.595	0.602	0.609	0.617	0.624	0.631	0.639	0.646	90
100	0.646	0.653	0.661	0.668	0.675	0.683	0.690	0.698	0.705	0.713	0.720	100
110	0.720	0.727	0.735	0.743	0.750	0.758	0.765	0.773	0.780	0.788	0.795	110
120	0.795	0.803	0.811	0.818	0.826	0.834	0.841	0.849	0.857	0.865	0.872	120
130	0.872	0.880	0.888	0.896	0.903	0.911	0.919	0.927	0.935	0.942	0.950	130
140	0.950	0.958	0.966	0.974	0.982	0.990	0.998	1.006	1.013	1.021	1.029	140
150	1.029	1.037	1.045	1.053	1.061	1.069	1.077	1.085	1.094	1.102	1.110	150
160	1.110	1.118	1.126	1.134	1.142	1.150	1.158	1.167	1.175	1.183	1.191	160
170	1.191	1.199	1.207	1.216	1.224	1.232	1.240	1.249	1.257	1.265	1.273	170
180	1.273	1.282	1.290	1.298	1.307	1.315	1.323	1.332	1.340	1.348	1.357	180
190	1.357	1.365	1.373	1.382	1.390	1.399	1.407	1.415	1.424	1.432	1.441	190
200	1.441	1.449	1.458	1.466	1.475	1.483	1.492	1.500	1.509	1.517	1.526	200
210	1.526	1.534	1.543	1.551	1.560	1.569	1.577	1.586	1.594	1.603	1.612	210
220	1.612	1.620	1.629	1.638	1.646	1.655	1.663	1.672	1.681	1.690	1.698	220
230	1.698	1.707	1.716	1.724	1.733	1.742	1.751	1.759	1.768	1.777	1.786	230
240	1.786	1.794	1.803	1.812	1.821	1.829	1.838	1.847	1.856	1.865	1.874	240

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°F 0 1 2 3 4 5 6 7 8 9 10 °F °C 0 1 2 3 4 5 6 7 8 9 10 °C

450 °F - 950 °F

Type S - PT 10% RH vs Platinum

250 °C - 550 °C

EMF in Millivolts — Reference Junction 32°F												EMF in Millivolts — Reference Junctions 0 °C													
°F	0	1	2	3	4	5	6	7	8	9	10	°F	°C	0	1	2	3	4	5	6	7	8	9	10	°C
450	1.718	1.722	1.727	1.732	1.737	1.742	1.747	1.752	1.756	1.761	1.766	450	250	1.874	1.882	1.891	1.900	1.909	1.918	1.927	1.936	1.944	1.953	1.962	250
460	1.766	1.771	1.776	1.781	1.786	1.790	1.795	1.800	1.805	1.810	1.815	460	260	1.962	1.971	1.980	1.989	1.998	2.007	2.016	2.025	2.034	2.043	2.052	260
470	1.815	1.820	1.825	1.829	1.834	1.839	1.844	1.849	1.854	1.859	1.864	470	270	2.052	2.061	2.070	2.078	2.087	2.096	2.105	2.114	2.123	2.132	2.141	270
480	1.864	1.869	1.874	1.878	1.883	1.888	1.893	1.898	1.903	1.908	1.913	480	280	2.141	2.151	2.160	2.169	2.178	2.187	2.196	2.205	2.214	2.223	2.232	280
490	1.913	1.918	1.923	1.928	1.933	1.938	1.942	1.947	1.952	1.957	1.962	490	290	2.232	2.241	2.250	2.259	2.268	2.277	2.287	2.296	2.305	2.314	2.323	290
500	1.962	1.967	1.972	1.977	1.982	1.987	1.992	1.997	2.002	2.007	2.012	500	300	2.323	2.332	2.341	2.350	2.360	2.369	2.378	2.387	2.396	2.405	2.415	300
510	2.012	2.017	2.022	2.027	2.032	2.037	2.042	2.047	2.052	2.057	2.062	510	310	2.415	2.424	2.433	2.442	2.451	2.461	2.470	2.479	2.488	2.497	2.507	310
520	2.062	2.067	2.072	2.076	2.081	2.086	2.091	2.096	2.101	2.106	2.111	520	320	2.507	2.516	2.525	2.534	2.544	2.553	2.562	2.571	2.581	2.590	2.599	320
530	2.111	2.116	2.121	2.126	2.131	2.136	2.141	2.147	2.152	2.157	2.162	530	330	2.599	2.609	2.618	2.627	2.636	2.646	2.655	2.664	2.674	2.683	2.692	330
540	2.162	2.167	2.172	2.177	2.182	2.187	2.192	2.197	2.202	2.207	2.212	540	340	2.692	2.702	2.711	2.720	2.730	2.739	2.748	2.758	2.767	2.776	2.786	340
550	2.212	2.217	2.222	2.227	2.232	2.237	2.242	2.247	2.252	2.257	2.262	550	350	2.786	2.795	2.805	2.814	2.823	2.833	2.842	2.851	2.861	2.870	2.880	350
560	2.262	2.267	2.272	2.277	2.283	2.288	2.293	2.298	2.303	2.308	2.313	560	360	2.880	2.889	2.899	2.908	2.917	2.927	2.936	2.946	2.955	2.965	2.974	360
570	2.313	2.318	2.323	2.328	2.333	2.338	2.343	2.348	2.354	2.359	2.364	570	370	2.974	2.983	2.993	3.002	3.012	3.021	3.031	3.040	3.050	3.059	3.069	370
580	2.364	2.369	2.374	2.379	2.384	2.389	2.394	2.399	2.404	2.410	2.415	580	380	3.069	3.078	3.088	3.097	3.107	3.116	3.126	3.135	3.145	3.154	3.164	380
590	2.415	2.420	2.425	2.430	2.435	2.440	2.445	2.450	2.455	2.461	2.466	590	390	3.164	3.173	3.183	3.192	3.202	3.212	3.221	3.231	3.240	3.250	3.259	390
600	2.466	2.471	2.476	2.481	2.486	2.491	2.496	2.502	2.507	2.512	2.517	600	400	3.259	3.269	3.279	3.288	3.298	3.307	3.317	3.326	3.336	3.346	3.355	400
610	2.517	2.522	2.527	2.532	2.538	2.543	2.548	2.553	2.558	2.563	2.568	610	410	3.355	3.365	3.374	3.384	3.394	3.403	3.413	3.423	3.432	3.442	3.451	410
620	2.568	2.574	2.579	2.584	2.589	2.594	2.599	2.604	2.610	2.615	2.620	620	420	3.451	3.461	3.471	3.480	3.490	3.500	3.509	3.519	3.529	3.538	3.548	420
630	2.620	2.625	2.630	2.635	2.641	2.646	2.651	2.656	2.661	2.666	2.672	630	430	3.548	3.558	3.567	3.577	3.587	3.596	3.606	3.616	3.626	3.635	3.645	430
640	2.672	2.677	2.682	2.687	2.692	2.697	2.703	2.708	2.713	2.718	2.723	640	440	3.645	3.655	3.664	3.674	3.684	3.694	3.703	3.713	3.723	3.732	3.742	440
650	2.723	2.729	2.734	2.739	2.744	2.749	2.755	2.760	2.765	2.770	2.775	650	450	3.742	3.752	3.762	3.771	3.781	3.791	3.801	3.810	3.820	3.830	3.840	450
660	2.775	2.781	2.786	2.791	2.796	2.801	2.807	2.812	2.817	2.822	2.827	660	460	3.840	3.850	3.859	3.869	3.879	3.889	3.898	3.908	3.918	3.928	3.938	460
670	2.827	2.833	2.838	2.843	2.848	2.854	2.859	2.864	2.869	2.874	2.880	670	470	3.938	3.947	3.957	3.967	3.977	3.987	3.997	4.006	4.016	4.026	4.036	470
680	2.880	2.885	2.890	2.895	2.901	2.906	2.911	2.916	2.922	2.927	2.932	680	480	4.036	4.046	4.056	4.065	4.075	4.085	4.095	4.105	4.115	4.125	4.134	480
690	2.932	2.937	2.943	2.948	2.953	2.958	2.964	2.969	2.974	2.979	2.985	690	490	4.134	4.144	4.154	4.164	4.174	4.184	4.194	4.204	4.213	4.223	4.233	490
700	2.985	2.990	2.995	3.000	3.006	3.011	3.016	3.021	3.027	3.032	3.037	700	500	4.233	4.243	4.253	4.263	4.273	4.283	4.293	4.303	4.313	4.323	4.332	500
710	3.037	3.042	3.048	3.053	3.058	3.063	3.069	3.074	3.079	3.085	3.090	710	510	4.332	4.342	4.352	4.362	4.372	4.382	4.392	4.402	4.412	4.422	4.432	510
720	3.090	3.095	3.100	3.106	3.111	3.116	3.122	3.127	3.132	3.137	3.143	720	520	4.432	4.442	4.452	4.462	4.472	4.482	4.492	4.502	4.512	4.522	4.532	520
730	3.143	3.148	3.153	3.159	3.164	3.169	3.174	3.180	3.185	3.190	3.196	730	530	4.532	4.542	4.552	4.562	4.572	4.582	4.592	4.602	4.612	4.622	4.632	530
740	3.196	3.201	3.206	3.212	3.217	3.222	3.227	3.233	3.238	3.243	3.249	740	540	4.632	4.642	4.652	4.662	4.672	4.682	4.692	4.702	4.712	4.722	4.732	540
750	3.249	3.254	3.259	3.265	3.270	3.275	3.281	3.286	3.291	3.297	3.302	750	550												
760	3.302	3.307	3.313	3.318	3.323	3.329	3.334	3.339	3.345	3.350	3.355	760													
770	3.355	3.361	3.366	3.371	3.377	3.382	3.387	3.393	3.398	3.403	3.409	770													
780	3.409	3.414	3.419	3.425	3.430	3.435	3.441	3.446	3.451	3.457	3.462	780													
790	3.462	3.468	3.473	3.478	3.484	3.489	3.494	3.500	3.505	3.510	3.516	790													
800	3.516	3.521	3.527	3.532	3.537	3.543	3.548	3.553	3.559	3.564	3.570	800													
810	3.570	3.575	3.580	3.586	3.591	3.596	3.602	3.607	3.613	3.618	3.623	810													
820	3.623	3.629	3.634	3.640	3.645	3.650	3.656	3.661	3.667	3.672	3.677	820													
830	3.677	3.683	3.688	3.694	3.699	3.704	3.710	3.715	3.721	3.726	3.731	830													
840	3.731	3.737	3.742	3.748	3.753	3.758	3.764	3.769	3.775	3.780	3.786	840													
850	3.786	3.791	3.796	3.802	3.807	3.813	3.818	3.823	3.829	3.834	3.840	850													
860	3.840	3.845	3.851	3.856	3.862	3.867	3.872	3.878	3.883	3.889	3.894	860													
870	3.894	3.900	3.905	3.910	3.916	3.921	3.927	3.932	3.938	3.943	3.949	870													
880	3.949	3.954	3.959	3.965	3.970	3.976	3.981	3.987	3.992	3.998	4.003	880													
890	4.003	4.009	4.014	4.020	4.025	4.030	4.036	4.041	4.047	4.052	4.058	890													
900	4.058	4.063	4.069	4.074	4.080	4.085	4.091	4.096	4.102	4.107	4.113	900													
910	4.113	4.118	4.123	4.129	4.134	4.140	4.145	4.151	4.156	4.162	4.167	910													
920	4.167	4.173	4.178	4.184	4.189	4.195	4.200	4.206	4.211	4.217	4.222	920													
930	4.222	4.228	4.233	4.239	4.244	4.250	4.255	4.261	4.266	4.272	4.277	930													
940	4.277	4.283	4.288	4.294	4.299	4.305	4.310	4.316	4.321	4.327	4.332	940													

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°F	0	1	2	3	4	5	6	7	8	9	10	°F	°C	0	1	2	3	4	5	6	7	8	9	10	°C
	EMF in Millivolts — Reference Junction 32°F												EMF in Millivolts — Reference Junctions 0 °C												
950	4.332	4.338	4.343	4.349	4.355	4.360	4.366	4.371	4.377	4.382	4.388	950	550	4.732	4.742	4.752	4.762	4.772	4.782	4.793	4.803	4.813	4.823	4.833	550
960	4.388	4.393	4.399	4.404	4.410	4.415	4.421	4.426	4.432	4.437	4.443	960	560	4.833	4.843	4.853	4.863	4.873	4.883	4.893	4.904	4.914	4.924	4.934	560
970	4.443	4.449	4.454	4.460	4.465	4.471	4.476	4.482	4.487	4.493	4.498	970	570	4.934	4.944	4.954	4.964	4.974	4.984	4.995	5.005	5.015	5.025	5.035	570
980	4.498	4.504	4.510	4.515	4.521	4.526	4.532	4.537	4.543	4.548	4.554	980	580	5.035	5.045	5.055	5.066	5.076	5.086	5.096	5.106	5.116	5.127	5.137	580
990	4.554	4.559	4.565	4.571	4.576	4.582	4.587	4.593	4.598	4.604	4.610	990	590	5.137	5.147	5.157	5.167	5.178	5.188	5.198	5.208	5.218	5.228	5.239	590
1000	4.610	4.615	4.621	4.626	4.632	4.637	4.643	4.648	4.654	4.660	4.665	1000	600	5.239	5.249	5.259	5.269	5.280	5.290	5.300	5.310	5.320	5.331	5.341	600
1010	4.665	4.671	4.676	4.682	4.688	4.693	4.699	4.704	4.710	4.715	4.721	1010	610	5.341	5.351	5.361	5.372	5.382	5.392	5.402	5.413	5.423	5.433	5.443	610
1020	4.721	4.727	4.732	4.738	4.743	4.749	4.755	4.760	4.766	4.771	4.777	1020	620	5.443	5.454	5.464	5.474	5.485	5.495	5.505	5.515	5.526	5.536	5.546	620
1030	4.777	4.782	4.788	4.794	4.799	4.805	4.810	4.816	4.822	4.827	4.833	1030	630	5.546	5.557	5.567	5.577	5.588	5.598	5.608	5.618	5.629	5.639	5.649	630
1040	4.833	4.838	4.844	4.850	4.855	4.861	4.866	4.872	4.878	4.883	4.889	1040	640	5.649	5.660	5.670	5.680	5.691	5.701	5.712	5.722	5.732	5.743	5.753	640
1050	4.889	4.895	4.900	4.906	4.911	4.917	4.923	4.928	4.934	4.939	4.945	1050	650	5.753	5.763	5.774	5.784	5.794	5.805	5.815	5.826	5.836	5.846	5.857	650
1060	4.945	4.951	4.956	4.962	4.968	4.973	4.979	4.984	4.990	4.996	5.001	1060	660	5.857	5.867	5.878	5.888	5.898	5.909	5.919	5.930	5.940	5.950	5.961	660
1070	5.001	5.007	5.013	5.018	5.024	5.030	5.035	5.041	5.046	5.052	5.058	1070	670	5.961	5.971	5.982	5.992	6.003	6.013	6.024	6.034	6.044	6.055	6.065	670
1080	5.058	5.063	5.069	5.075	5.080	5.086	5.092	5.097	5.103	5.109	5.114	1080	680	6.065	6.076	6.086	6.097	6.107	6.118	6.128	6.139	6.149	6.160	6.170	680
1090	5.114	5.120	5.125	5.131	5.137	5.142	5.148	5.154	5.159	5.165	5.171	1090	690	6.170	6.181	6.191	6.202	6.212	6.223	6.233	6.244	6.254	6.265	6.275	690
1100	5.171	5.176	5.182	5.188	5.193	5.199	5.205	5.210	5.216	5.222	5.227	1100	700	6.275	6.286	6.296	6.307	6.317	6.328	6.338	6.349	6.360	6.370	6.381	700
1110	5.227	5.233	5.239	5.244	5.250	5.256	5.261	5.267	5.273	5.278	5.284	1110	710	6.381	6.391	6.402	6.412	6.423	6.434	6.444	6.455	6.465	6.476	6.486	710
1120	5.284	5.290	5.295	5.301	5.307	5.312	5.318	5.324	5.330	5.335	5.341	1120	720	6.486	6.497	6.508	6.518	6.529	6.539	6.550	6.561	6.571	6.582	6.593	720
1130	5.341	5.347	5.352	5.358	5.364	5.369	5.375	5.381	5.386	5.392	5.398	1130	730	6.593	6.603	6.614	6.624	6.635	6.646	6.656	6.667	6.678	6.688	6.699	730
1140	5.398	5.404	5.409	5.415	5.421	5.426	5.432	5.438	5.443	5.449	5.455	1140	740	6.699	6.710	6.720	6.731	6.742	6.752	6.763	6.774	6.784	6.795	6.806	740
1150	5.455	5.461	5.466	5.472	5.478	5.483	5.489	5.495	5.501	5.506	5.512	1150	750	6.806	6.817	6.827	6.838	6.849	6.859	6.870	6.881	6.892	6.902	6.913	750
1160	5.512	5.518	5.523	5.529	5.535	5.541	5.546	5.552	5.558	5.563	5.569	1160	760	6.913	6.924	6.934	6.945	6.956	6.967	6.977	6.988	6.999	7.010	7.020	760
1170	5.569	5.575	5.581	5.586	5.592	5.598	5.604	5.609	5.615	5.621	5.627	1170	770	7.020	7.031	7.042	7.053	7.064	7.074	7.085	7.096	7.107	7.117	7.128	770
1180	5.627	5.632	5.638	5.644	5.649	5.655	5.661	5.667	5.672	5.678	5.684	1180	780	7.128	7.139	7.150	7.161	7.172	7.182	7.193	7.204	7.215	7.226	7.236	780
1190	5.684	5.690	5.695	5.701	5.707	5.713	5.718	5.724	5.730	5.736	5.741	1190	790	7.236	7.247	7.258	7.269	7.280	7.291	7.302	7.312	7.323	7.334	7.345	790
1200	5.741	5.747	5.753	5.759	5.764	5.770	5.776	5.782	5.788	5.793	5.799	1200	800	7.345	7.356	7.367	7.378	7.388	7.399	7.410	7.421	7.432	7.443	7.454	800
1210	5.799	5.805	5.811	5.816	5.822	5.828	5.834	5.839	5.845	5.851	5.857	1210	810	7.454	7.465	7.476	7.487	7.497	7.508	7.519	7.530	7.541	7.552	7.563	810
1220	5.857	5.863	5.868	5.874	5.880	5.886	5.891	5.897	5.903	5.909	5.915	1220	820	7.563	7.574	7.585	7.596	7.607	7.618	7.629	7.640	7.651	7.662	7.673	820
1230	5.915	5.920	5.926	5.932	5.938	5.944	5.949	5.955	5.961	5.967	5.972	1230	830	7.673	7.684	7.695	7.706	7.717	7.728	7.739	7.750	7.761	7.772	7.783	830
1240	5.972	5.978	5.984	5.990	5.996	6.001	6.007	6.013	6.019	6.025	6.030	1240	840	7.783	7.794	7.805	7.816	7.827	7.838	7.849	7.860	7.871	7.882	7.893	840
1250	6.030	6.036	6.042	6.048	6.054	6.060	6.065	6.071	6.077	6.083	6.089	1250													
1260	6.089	6.094	6.100	6.106	6.112	6.118	6.124	6.129	6.135	6.141	6.147	1260													
1270	6.147	6.153	6.158	6.164	6.170	6.176	6.182	6.188	6.193	6.199	6.205	1270													
1280	6.205	6.211	6.217	6.223	6.228	6.234	6.240	6.246	6.252	6.258	6.264	1280													
1290	6.264	6.269	6.275	6.281	6.287	6.293	6.299	6.305	6.310	6.316	6.322	1290													
1300	6.322	6.328	6.334	6.340	6.346	6.351	6.357	6.363	6.369	6.375	6.381	1300													
1310	6.381	6.387	6.392	6.398	6.404	6.410	6.416	6.422	6.428	6.434	6.439	1310													
1320	6.439	6.445	6.451	6.457	6.463	6.469	6.475	6.481	6.486	6.492	6.498	1320													
1330	6.498	6.504	6.510	6.516	6.522	6.528	6.534	6.539	6.545	6.551	6.557	1330													
1340	6.557	6.563	6.569	6.575	6.581	6.587	6.593	6.598	6.604	6.610	6.616	1340													
1350	6.616	6.622	6.628	6.634	6.640	6.646	6.652	6.658	6.664	6.669	6.675	1350													
1360	6.675	6.681	6.687	6.693	6.699	6.705	6.711	6.717	6.723	6.729	6.735	1360													
1370	6.735	6.741	6.746	6.752	6.758	6.764	6.770	6.776	6.782	6.788	6.794	1370													
1380	6.794	6.800	6.806	6.812	6.818	6.824	6.830	6.836	6.842	6.847	6.853	1380													
1390	6.853	6.859	6.865	6.871	6.877	6.883	6.889	6.895	6.901	6.907	6.913	1390													
1400	6.913	6.919	6.925	6.931	6.937	6.943	6.949	6																	

1450 °F - 1950 °F

Type S - PT 10% RH vs Platinum

850 °C - 1150 °C

°F	0	1	2	3	4	5	6	7	8	9	10
EMF in Millivolts — Reference Junction 32°F											
1450	7.212	7.218	7.224	7.230	7.236	7.242	7.249	7.255	7.261	7.267	7.273
1460	7.273	7.279	7.285	7.291	7.297	7.303	7.309	7.315	7.321	7.327	7.333
1470	7.333	7.339	7.345	7.351	7.357	7.363	7.369	7.375	7.381	7.387	7.393
1480	7.393	7.399	7.405	7.411	7.418	7.424	7.430	7.436	7.442	7.448	7.454
1490	7.454	7.460	7.466	7.472	7.478	7.484	7.490	7.496	7.502	7.508	7.514
1500	7.514	7.521	7.527	7.533	7.539	7.545	7.551	7.557	7.563	7.569	7.575
1510	7.575	7.581	7.587	7.593	7.600	7.606	7.612	7.618	7.624	7.630	7.636
1520	7.636	7.642	7.648	7.654	7.660	7.667	7.673	7.679	7.685	7.691	7.697
1530	7.697	7.703	7.709	7.715	7.721	7.728	7.734	7.740	7.746	7.752	7.758
1540	7.758	7.764	7.770	7.776	7.783	7.789	7.795	7.801	7.807	7.813	7.819
1550	7.819	7.825	7.832	7.838	7.844	7.850	7.856	7.862	7.868	7.874	7.881
1560	7.881	7.887	7.893	7.899	7.905	7.911	7.917	7.923	7.930	7.936	7.942
1570	7.942	7.948	7.954	7.960	7.966	7.973	7.979	7.985	7.991	7.997	8.003
1580	8.003	8.010	8.016	8.022	8.028	8.034	8.040	8.047	8.053	8.059	8.065
1590	8.065	8.071	8.077	8.083	8.090	8.096	8.102	8.108	8.114	8.121	8.127
1600	8.127	8.133	8.139	8.145	8.151	8.158	8.164	8.170	8.176	8.182	8.189
1610	8.189	8.195	8.201	8.207	8.213	8.219	8.226	8.232	8.238	8.244	8.250
1620	8.250	8.257	8.263	8.269	8.275	8.281	8.288	8.294	8.300	8.306	8.312
1630	8.312	8.319	8.325	8.331	8.337	8.343	8.350	8.356	8.362	8.368	8.375
1640	8.375	8.381	8.387	8.393	8.399	8.406	8.412	8.418	8.424	8.431	8.437
1650	8.437	8.443	8.449	8.455	8.462	8.468	8.474	8.480	8.487	8.493	8.499
1660	8.499	8.505	8.512	8.518	8.524	8.530	8.537	8.543	8.549	8.555	8.562
1670	8.562	8.568	8.574	8.580	8.587	8.593	8.599	8.605	8.612	8.618	8.624
1680	8.624	8.630	8.637	8.643	8.649	8.655	8.662	8.668	8.674	8.680	8.687
1690	8.687	8.693	8.699	8.706	8.712	8.718	8.724	8.731	8.737	8.743	8.749
1700	8.749	8.756	8.762	8.768	8.775	8.781	8.787	8.793	8.800	8.806	8.812
1710	8.812	8.819	8.825	8.831	8.837	8.844	8.850	8.856	8.863	8.869	8.875
1720	8.875	8.882	8.888	8.894	8.900	8.907	8.913	8.919	8.926	8.932	8.938
1730	8.938	8.945	8.951	8.957	8.964	8.970	8.976	8.983	8.989	8.995	9.001
1740	9.001	9.008	9.014	9.020	9.027	9.033	9.039	9.046	9.052	9.058	9.065
1750	9.065	9.071	9.077	9.084	9.090	9.096	9.103	9.109	9.115	9.122	9.128
1760	9.128	9.134	9.141	9.147	9.153	9.160	9.166	9.172	9.179	9.185	9.192
1770	9.192	9.198	9.204	9.211	9.217	9.223	9.230	9.236	9.242	9.249	9.255
1780	9.255	9.261	9.268	9.274	9.281	9.287	9.293	9.300	9.306	9.312	9.319
1790	9.319	9.325	9.331	9.338	9.344	9.351	9.357	9.363	9.370	9.376	9.382
1800	9.382	9.389	9.395	9.402	9.408	9.414	9.421	9.427	9.434	9.440	9.446
1810	9.446	9.453	9.459	9.465	9.472	9.478	9.485	9.491	9.497	9.504	9.510
1820	9.510	9.517	9.523	9.529	9.536	9.542	9.549	9.555	9.561	9.568	9.574
1830	9.574	9.581	9.587	9.594	9.600	9.606	9.613	9.619	9.626	9.632	9.638
1840	9.638	9.645	9.651	9.658	9.664	9.671	9.677	9.683	9.690	9.696	9.703
1850	9.703	9.709	9.716	9.722	9.728	9.735	9.741	9.748	9.754	9.761	9.767
1860	9.767	9.773	9.780	9.786	9.793	9.799	9.806	9.812	9.819	9.825	9.831
1870	9.831	9.838	9.844	9.851	9.857	9.864	9.870	9.877	9.883	9.889	9.896
1880	9.896	9.902	9.909	9.915	9.922	9.928	9.935	9.941	9.948	9.954	9.961
1890	9.961	9.967	9.973	9.980	9.986	9.993	9.999	10.006	10.012	10.019	10.025
1900	10.025	10.032	10.038	10.045	10.051	10.058	10.064	10.071	10.077	10.084	10.090
1910	10.090	10.097	10.103	10.110	10.116	10.123	10.129	10.136	10.142	10.149	10.155
1920	10.155	10.162	10.168	10.175	10.181	10.188	10.194	10.201	10.207	10.214	10.220
1930	10.220	10.227	10.233	10.240	10.246	10.253	10.259	10.266	10.272	10.279	10.285
1940	10.285	10.292	10.298	10.305	10.311	10.318	10.324	10.331	10.337	10.344	10.350

°F	0	1	2	3	4	5	6	7	8	9	10
EMF in Millivolts — Reference Junctions 0 °C											
1450	7.893	7.904	7.915	7.926	7.937	7.948	7.959	7.970	7.981	7.992	8.003
1460	8.003	8.014	8.026	8.037	8.048	8.059	8.070	8.081	8.092	8.103	8.114
1470	8.114	8.125	8.137	8.148	8.159	8.170	8.181	8.192	8.203	8.214	8.226
1480	8.226	8.237	8.248	8.259	8.270	8.281	8.293	8.304	8.315	8.326	8.337
1490	8.337	8.348	8.360	8.371	8.382	8.393	8.404	8.416	8.427	8.438	8.449
1500	8.449	8.460	8.472	8.483	8.494	8.505	8.517	8.528	8.539	8.550	8.562
1510	8.562	8.573	8.584	8.595	8.607	8.618	8.629	8.640	8.652	8.663	8.674
1520	8.674	8.685	8.697	8.708	8.719	8.731	8.742	8.753	8.765	8.776	8.787
1530	8.787	8.798	8.810	8.821	8.832	8.844	8.855	8.866	8.878	8.889	8.900
1540	8.900	8.912	8.923	8.935	8.946	8.957	8.969	8.980	8.991	9.003	9.014
1550	9.014	9.025	9.037	9.048	9.060	9.071	9.082	9.094	9.105	9.117	9.128
1560	9.128	9.139	9.151	9.162	9.174	9.185	9.197	9.208	9.219	9.231	9.242
1570	9.242	9.254	9.265	9.277	9.288	9.300	9.311	9.323	9.334	9.345	9.357
1580	9.357	9.368	9.380	9.391	9.403	9.414	9.426	9.437	9.449	9.460	9.472
1590	9.472	9.483	9.495	9.506	9.518	9.529	9.541	9.552	9.564	9.576	9.587
1600	9.587	9.599	9.610	9.622	9.633	9.645	9.656	9.668	9.680	9.691	9.703
1610	9.703	9.714	9.726	9.737	9.749	9.761	9.772	9.784	9.795	9.807	9.819
1620	9.819	9.830	9.842	9.853	9.865	9.877	9.888	9.900	9.911	9.923	9.935
1630	9.935	9.946	9.958	9.970	9.981	9.993	10.005	10.016	10.028	10.040	10.051
1640	10.051	10.063	10.075	10.086	10.098	10.110	10.121	10.133	10.145	10.156	10.168
1650	10.168	10.180	10.191	10.203	10.215	10.227	10.238	10.250	10.262	10.273	10.285
1660	10.285	10.297	10.309	10.320	10.332	10.344	10.356	10.367	10.379	10.391	10.403
1670	10.403	10.414	10.426	10.438	10.450	10.461	10.473	10.485	10.497	10.509	10.520
1680	10.520	10.532	10.544	10.556	10.567	10.579	10.591	10.603	10.615	10.626	10.638
1690	10.638	10.650	10.662	10.674	10.686	10.697	10.709	10.721	10.733	10.745	10.757
1700	10.757	10.768	10.780	10.792	10.804	10.816	10.828	10.839	10.851	10.863	10.875
1710	10.875	10.887	10.899	10.911	10.922	10.934	10.946	10.958	10.970	10.982	10.994
1720	10.994	11.006	11.017	11.029	11.041	11.053	11.065	11.077	11.089	11.101	11.113
1730	11.113	11.125	11.136	11.148	11.160	11.172	11.184	11.196	11.208	11.220	11.232
1740	11.232	11.244	11.256	11.268	11.280	11.291	11.303	11.315	11.327	11.339	11.351

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S

°F	0	1	2	3	4	5	6	7	8	9	10	°F	°C	0	1	2	3	4	5	6	7	8	9	10	°C
EMF in Millivolts — Reference Junction 32°F												EMF in Millivolts — Reference Junctions 0 °C													
1950	10.350	10.357	10.363	10.370	10.376	10.383	10.390	10.396	10.403	10.409	10.416	1950	1150	11.351	11.363	11.375	11.387	11.399	11.411	11.423	11.435	11.447	11.459	11.471	1150
1960	10.416	10.422	10.429	10.435	10.442	10.448	10.455	10.461	10.468	10.475	10.481	1960	1160	11.471	11.483	11.495	11.507	11.519	11.531	11.542	11.554	11.566	11.578	11.590	1160
1970	10.481	10.488	10.494	10.501	10.507	10.514	10.520	10.527	10.533	10.540	10.547	1970	1170	11.590	11.602	11.614	11.626	11.638	11.650	11.662	11.674	11.686	11.698	11.710	1170
1980	10.547	10.553	10.560	10.566	10.573	10.579	10.586	10.592	10.599	10.606	10.612	1980	1180	11.710	11.722	11.734	11.746	11.758	11.770	11.782	11.794	11.806	11.818	11.830	1180
1990	10.612	10.619	10.625	10.632	10.638	10.645	10.651	10.658	10.665	10.671	10.678	1990	1190	11.830	11.842	11.854	11.866	11.878	11.890	11.902	11.914	11.926	11.939	11.951	1190
2000	10.678	10.684	10.691	10.697	10.704	10.711	10.717	10.724	10.730	10.737	10.743	2000	1200	11.951	11.963	11.975	11.987	11.999	12.011	12.023	12.035	12.047	12.059	12.071	1200
2010	10.743	10.750	10.757	10.763	10.770	10.776	10.783	10.789	10.796	10.803	10.809	2010	1210	12.071	12.083	12.095	12.107	12.119	12.131	12.143	12.155	12.167	12.179	12.191	1210
2020	10.809	10.816	10.822	10.829	10.836	10.842	10.849	10.855	10.862	10.868	10.875	2020	1220	12.191	12.203	12.216	12.228	12.240	12.252	12.264	12.276	12.288	12.300	12.312	1220
2030	10.875	10.882	10.888	10.895	10.901	10.908	10.915	10.921	10.928	10.934	10.941	2030	1230	12.312	12.324	12.336	12.348	12.360	12.372	12.384	12.397	12.409	12.421	12.433	1230
2040	10.941	10.948	10.954	10.961	10.967	10.974	10.981	10.987	10.994	11.000	11.007	2040	1240	12.433	12.445	12.457	12.469	12.481	12.493	12.505	12.517	12.529	12.542	12.554	1240
2050	11.007	11.014	11.020	11.027	11.033	11.040	11.047	11.053	11.060	11.066	11.073	2050	1250	12.554	12.566	12.578	12.590	12.602	12.614	12.626	12.638	12.650	12.662	12.675	1250
2060	11.073	11.080	11.086	11.093	11.099	11.106	11.113	11.119	11.126	11.132	11.139	2060	1260	12.675	12.687	12.699	12.711	12.723	12.735	12.747	12.759	12.771	12.783	12.796	1260
2070	11.139	11.146	11.152	11.159	11.166	11.172	11.179	11.185	11.192	11.199	11.205	2070	1270	12.796	12.808	12.820	12.832	12.844	12.856	12.868	12.880	12.892	12.905	12.917	1270
2080	11.205	11.212	11.219	11.225	11.232	11.238	11.245	11.252	11.258	11.265	11.272	2080	1280	12.917	12.929	12.941	12.953	12.965	12.977	12.989	13.001	13.014	13.026	13.038	1280
2090	11.272	11.278	11.285	11.291	11.298	11.305	11.311	11.318	11.325	11.331	11.338	2090	1290	13.038	13.050	13.062	13.074	13.086	13.098	13.111	13.123	13.135	13.147	13.159	1290
2100	11.338	11.345	11.351	11.358	11.364	11.371	11.378	11.384	11.391	11.398	11.404	2100	1300	13.159	13.171	13.183	13.195	13.208	13.220	13.232	13.244	13.256	13.268	13.280	1300
2110	11.404	11.411	11.418	11.424	11.431	11.437	11.444	11.451	11.457	11.464	11.471	2110	1310	13.280	13.292	13.305	13.317	13.329	13.341	13.353	13.365	13.377	13.390	13.402	1310
2120	11.471	11.477	11.484	11.491	11.497	11.504	11.511	11.517	11.524	11.531	11.537	2120	1320	13.402	13.414	13.426	13.438	13.450	13.462	13.474	13.487	13.499	13.511	13.523	1320
2130	11.537	11.544	11.550	11.557	11.564	11.570	11.577	11.584	11.590	11.597	11.604	2130	1330	13.523	13.535	13.547	13.559	13.572	13.584	13.596	13.608	13.620	13.632	13.644	1330
2140	11.604	11.610	11.617	11.624	11.630	11.637	11.644	11.650	11.657	11.664	11.670	2140	1340	13.644	13.657	13.669	13.681	13.693	13.705	13.717	13.729	13.742	13.754	13.766	1340
2150	11.670	11.677	11.684	11.690	11.697	11.704	11.710	11.717	11.724	11.730	11.737	2150	1350	13.766	13.778	13.790	13.802	13.814	13.826	13.839	13.851	13.863	13.875	13.887	1350
2160	11.737	11.744	11.750	11.757	11.764	11.770	11.777	11.784	11.790	11.797	11.804	2160	1360	13.887	13.899	13.911	13.924	13.936	13.948	13.960	13.972	13.984	13.996	14.009	1360
2170	11.804	11.810	11.817	11.824	11.830	11.837	11.844	11.850	11.857	11.864	11.870	2170	1370	14.009	14.021	14.033	14.045	14.057	14.069	14.081	14.094	14.106	14.118	14.130	1370
2180	11.870	11.877	11.884	11.890	11.897	11.904	11.910	11.917	11.924	11.931	11.937	2180	1380	14.130	14.142	14.154	14.166	14.178	14.191	14.203	14.215	14.227	14.239	14.251	1380
2190	11.937	11.944	11.951	11.957	11.964	11.971	11.977	11.984	11.991	11.997	12.004	2190	1390	14.251	14.263	14.276	14.288	14.300	14.312	14.324	14.336	14.348	14.360	14.373	1390
2200	12.004	12.011	12.017	12.024	12.031	12.037	12.044	12.051	12.058	12.064	12.071	2200	1400	14.373	14.385	14.397	14.409	14.421	14.433	14.445	14.457	14.470	14.482	14.494	1400
2210	12.071	12.078	12.084	12.091	12.098	12.104	12.111	12.118	12.124	12.131	12.138	2210	1410	14.494	14.506	14.518	14.530	14.542	14.554	14.567	14.579	14.591	14.603	14.615	1410
2220	12.138	12.145	12.151	12.158	12.165	12.171	12.178	12.185	12.191	12.198	12.205	2220	1420	14.615	14.627	14.639	14.651	14.664	14.676	14.688	14.700	14.712	14.724	14.736	1420
2230	12.205	12.211	12.218	12.225	12.232	12.238	12.245	12.252	12.258	12.265	12.272	2230	1430	14.736	14.748	14.760	14.773	14.785	14.797	14.809	14.821	14.833	14.845	14.857	1430
2240	12.272	12.278	12.285	12.292	12.299	12.305	12.312	12.319	12.325	12.332	12.339	2240	1440	14.857	14.869	14.881	14.894	14.906	14.918	14.930	14.942	14.954	14.966	14.978	1440
2250	12.339	12.346	12.352	12.359	12.366	12.372	12.379	12.386	12.392	12.399	12.406	2250													
2260	12.406	12.413	12.419	12.426	12.433	12.439	12.446	12.453	12.460	12.466	12.473	2260													
2270	12.473	12.480	12.486	12.493	12.500	12.507	12.513	12.520	12.527	12.533	12.540	2270													
2280	12.540	12.547	12.554	12.560	12.567	12.574	12.580	12.587	12.594	12.601	12.607	2280													
2290	12.607	12.614	12.621	12.627	12.634	12.641	12.648	12.654	12.661	12.668	12.675	2290													
2300	12.675	12.681	12.688	12.695	12.701	12.708	12.715	12.722	12.728	12.735	12.742	2300													
2310	12.742	12.748	12.755	12.762	12.769	12.775	12.782	12.789	12.796	12.802	12.809	2310													
2320	12.809	12.816	12.822	12.829	12.836	12.843	12.849	12.856	12.863	12.870	12.876	2320													
2330	12.876	12.883	12.890	12.896	12.903	12.910	12.917	12.923	12.930	12.937	12.944	2330													
2340	12.944	12.950	12.957	12.964	12.971	12.977	12.984	12.991	12.997	13.004	13.011	2340													
2350	13.011	13.018	13.024	13.031	13.038	13.045	13.051	13.058	13.065	13.072	13.078	2350													
2360	13.078	13.085	13.092	13.098	13.105	13.112	13.119	13.125	13.132	13.139	13.146	2360													
2370	13.146	13.152	13.159	13.166	13.173	13.179	13.186	13.193	13.199	13.206	13.213	2370													
2380	13.213	13.220	13.226	13.233	13.240	13.247	13.253	13.260	13.267	13.274	13.280	2380													
2390	13.280	13.287	13.294	13.301	13.307	13.314	13.321	13.328	13.334	13.341	13.348	2390													
2400	13.348	13.354	13.361	13.368	13.375	13.381	13.388	13.395	13.402	13.408	13.415	2400													
2410	13.415	13.422	13.429	13.435	13.442	13.449	13.456	13.462	13.469	13.476	13.483	2410													
2420	13.483	13.489	13.496	13.503	13.510	13.516	13.523	13.530																	

2450 °F - 2950 °F

Type S - PT 10% RH vs Platinum

1450 °C - 1750 °C

°F	0	1	2	3	4	5	6	7	8	9	10	°F	°C	0	1	2	3	4	5	6	7	8	9	10	°C
EMF in Millivolts — Reference Junction 32°F												EMF in Millivolts — Reference Junctions 0 °C													
2450	13.685	13.692	13.698	13.705	13.712	13.719	13.725	13.732	13.739	13.746	13.752	2450	1450	14.978	14.990	15.002	15.015	15.027	15.039	15.051	15.063	15.075	15.087	15.099	1450
2460	13.752	13.759	13.766	13.773	13.779	13.786	13.793	13.800	13.806	13.813	13.820	2460	1460	15.099	15.111	15.123	15.135	15.148	15.160	15.172	15.184	15.196	15.208	15.220	1460
2470	13.820	13.826	13.833	13.840	13.847	13.853	13.860	13.867	13.874	13.880	13.887	2470	1470	15.220	15.232	15.244	15.256	15.268	15.280	15.292	15.304	15.317	15.329	15.341	1470
2480	13.887	13.894	13.901	13.907	13.914	13.921	13.928	13.934	13.941	13.948	13.955	2480	1480	15.341	15.353	15.365	15.377	15.389	15.401	15.413	15.425	15.437	15.449	15.461	1480
2490	13.955	13.961	13.968	13.975	13.982	13.988	13.995	14.002	14.009	14.015	14.022	2490	1490	15.461	15.473	15.485	15.497	15.509	15.521	15.534	15.546	15.558	15.570	15.582	1490
2500	14.022	14.029	14.036	14.042	14.049	14.056	14.063	14.069	14.076	14.083	14.089	2500	1500	15.582	15.594	15.606	15.618	15.630	15.642	15.654	15.666	15.678	15.690	15.702	1500
2510	14.089	14.096	14.103	14.110	14.116	14.123	14.130	14.137	14.143	14.150	14.157	2510	1510	15.702	15.714	15.726	15.738	15.750	15.762	15.774	15.786	15.798	15.810	15.822	1510
2520	14.157	14.164	14.170	14.177	14.184	14.191	14.197	14.204	14.211	14.218	14.224	2520	1520	15.822	15.834	15.846	15.858	15.870	15.882	15.894	15.906	15.918	15.930	15.942	1520
2530	14.224	14.231	14.238	14.245	14.251	14.258	14.265	14.272	14.278	14.285	14.292	2530	1530	15.942	15.954	15.966	15.978	15.990	16.002	16.014	16.026	16.038	16.050	16.062	1530
2540	14.292	14.298	14.305	14.312	14.319	14.325	14.332	14.339	14.346	14.352	14.359	2540	1540	16.062	16.074	16.086	16.098	16.110	16.122	16.134	16.146	16.158	16.170	16.182	1540
2550	14.359	14.366	14.373	14.379	14.386	14.393	14.400	14.406	14.413	14.420	14.426	2550	1550	16.182	16.194	16.205	16.217	16.229	16.241	16.253	16.265	16.277	16.289	16.301	1550
2560	14.426	14.433	14.440	14.447	14.453	14.460	14.467	14.474	14.480	14.487	14.494	2560	1560	16.301	16.313	16.325	16.337	16.349	16.361	16.373	16.385	16.396	16.408	16.420	1560
2570	14.494	14.501	14.507	14.514	14.521	14.528	14.534	14.541	14.548	14.554	14.561	2570	1570	16.420	16.432	16.444	16.456	16.468	16.480	16.492	16.504	16.516	16.527	16.539	1570
2580	14.561	14.568	14.575	14.581	14.588	14.595	14.602	14.608	14.615	14.622	14.629	2580	1580	16.539	16.551	16.563	16.575	16.587	16.599	16.611	16.623	16.634	16.646	16.658	1580
2590	14.629	14.635	14.642	14.649	14.655	14.662	14.669	14.676	14.682	14.689	14.696	2590	1590	16.658	16.670	16.682	16.694	16.706	16.718	16.729	16.741	16.753	16.765	16.777	1590
2600	14.696	14.703	14.709	14.716	14.723	14.729	14.736	14.743	14.750	14.756	14.763	2600	1600	16.777	16.789	16.801	16.812	16.824	16.836	16.848	16.860	16.872	16.883	16.895	1600
2610	14.763	14.770	14.777	14.783	14.790	14.797	14.803	14.810	14.817	14.824	14.830	2610	1610	16.895	16.907	16.919	16.931	16.943	16.954	16.966	16.978	16.990	17.002	17.013	1610
2620	14.830	14.837	14.844	14.851	14.857	14.864	14.871	14.877	14.884	14.891	14.898	2620	1620	17.013	17.025	17.037	17.049	17.061	17.072	17.084	17.096	17.108	17.120	17.131	1620
2630	14.898	14.904	14.911	14.918	14.925	14.931	14.938	14.945	14.951	14.958	14.965	2630	1630	17.131	17.143	17.155	17.167	17.178	17.190	17.202	17.214	17.225	17.237	17.249	1630
2640	14.965	14.972	14.978	14.985	14.992	14.998	15.005	15.012	15.019	15.025	15.032	2640	1640	17.249	17.261	17.272	17.284	17.296	17.308	17.319	17.331	17.343	17.355	17.366	1640
2650	15.032	15.039	15.045	15.052	15.059	15.066	15.072	15.079	15.086	15.092	15.099	2650	1650	17.366	17.378	17.390	17.401	17.413	17.425	17.437	17.448	17.460	17.472	17.483	1650
2660	15.099	15.106	15.113	15.119	15.126	15.133	15.139	15.146	15.153	15.160	15.166	2660	1660	17.483	17.495	17.507	17.518	17.530	17.542	17.553	17.565	17.577	17.588	17.600	1660
2670	15.166	15.173	15.180	15.186	15.193	15.200	15.207	15.213	15.220	15.227	15.233	2670	1670	17.600	17.612	17.623	17.635	17.647	17.658	17.670	17.682	17.693	17.705	17.717	1670
2680	15.233	15.240	15.247	15.254	15.260	15.267	15.274	15.280	15.287	15.294	15.300	2680	1680	17.717	17.728	17.740	17.751	17.763	17.775	17.786	17.798	17.809	17.821	17.832	1680
2690	15.300	15.307	15.314	15.321	15.327	15.334	15.341	15.347	15.354	15.361	15.367	2690	1690	17.832	17.844	17.855	17.867	17.878	17.890	17.901	17.913	17.924	17.936	17.947	1690
2700	15.367	15.374	15.381	15.388	15.394	15.401	15.408	15.414	15.421	15.428	15.434	2700	1700	17.947	17.959	17.970	17.982	17.993	18.004	18.016	18.027	18.039	18.050	18.061	1700
2710	15.434	15.441	15.448	15.455	15.461	15.468	15.475	15.481	15.488	15.495	15.501	2710	1710	18.061	18.073	18.084	18.095	18.107	18.118	18.129	18.140	18.152	18.163	18.174	1710
2720	15.501	15.508	15.515	15.521	15.528	15.535	15.542	15.548	15.555	15.562	15.568	2720	1720	18.174	18.185	18.196	18.208	18.219	18.230	18.241	18.252	18.263	18.274	18.285	1720
2730	15.568	15.575	15.582	15.588	15.595	15.602	15.608	15.615	15.622	15.628	15.635	2730	1730	18.285	18.297	18.308	18.319	18.330	18.341	18.352	18.362	18.373	18.384	18.395	1730
2740	15.635	15.642	15.649	15.655	15.662	15.669	15.675	15.682	15.689	15.695	15.702	2740	1740	18.395	18.406	18.417	18.428	18.439	18.449	18.460	18.471	18.482	18.493	18.503	1740
2750	15.702	15.709	15.715	15.722	15.729	15.735	15.742	15.749	15.755	15.762	15.769	2750	1750	18.510	18.521	18.532	18.543	18.554	18.565	18.576	18.587	18.598	18.609	18.620	1750
2760	15.769	15.775	15.782	15.789	15.795	15.802	15.809	15.815	15.822	15.829	15.835	2760	1760	18.620	18.631	18.642	18.653	18.664	18.675	18.686	18.697	18.708	18.719	18.730	1760
2770	15.835	15.842	15.849	15.855	15.862	15.869	15.875	15.882	15.889	15.895	15.902	2770	1770	18.730	18.741	18.752	18.763	18.774	18.785	18.796	18.807	18.818	18.829	18.840	1770
2780	15.902	15.909	15.915	15.922	15.929	15.935	15.942	15.949	15.955	15.962	15.969	2780	1780	18.840	18.851	18.862	18.873	18.884	18.895	18.906	18.917	18.928	18.939	18.950	1780
2790	15.969	15.975	15.982	15.989	15.995	16.002	16.009	16.015	16.022	16.029	16.035	2790	1790	18.950	18.961	18.972	18.983	18.994	19.005	19.016	19.027	19.038	19.049	19.060	1790
2800	16.035	16.042	16.049	16.055	16.062	16.069	16.075	16.082	16.089	16.095	16.102	2800	1800	19.060	19.071	19.082	19.093	19.104	19.115	19.126	19.137	19.148	19.159	19.170	1800
2810	16.102	16.108	16.115	16.122	16.128	16.135	16.142	16.148	16.155	16.162	16.168	2810	1810	19.170	19.181	19.192	19.203	19.214	19.225	19.236	19.247	19.258	19.269	19.280	1810
2820	16.168	16.175	16.182	16.188	16.195	16.202	16.208	16.215	16.221	16.228	16.235	2820	1820	19.280	19.291	19.302	19.313	19.324	19.335	19.346	19.357	19.368	19.379	19.390	1820
2830	16.235	16.241	16.248	16.255	16.261	16.268	16.275	16.281	16.288	16.294	16.301	2830	1830	19.390	19.401	19.412	19.423	19.434	19.445	19.456	19.467	19.478	19.489	19.500	1830
2840	16.301	16.308	16.314	16.321	16.328	16.334	16.341	16.347	16.354	16.361	16.367	2840	1840	19.500	19.511	19.522	19.533	19.544	19.555	19.566	19.577	19.588	19.599	19.610	1840
2850	16.367	16.374	16.381	16.387	16.394	16.400	16.407	16.414	16.420	16.427	16.434	2850	1850	19.610	19.621	19.632	19.643	19.654	19.665	19.676	19.687	19.698	19.709	19.720	1850
2860	16.434	16.440	16.447	16.453	16.460	16.467	16.473	16.480	16.486	16.493	16.500	2860	1860	19.720	19.731	19.742	19.753	19.							

2950 °F - 3214 °F

Type S - PT 10% RH vs Platinum

1750 °C - 1768 °C

°F											°C												
0	1	2	3	4	5	6	7	8	9	10	0	1	2	3	4	5	6	7	8	9	10		
EMF in Millivolts — Reference Junction 32°F											EMF in Millivolts — Reference Junctions 0 °C												
<b>2950</b>	17.026	17.033	17.040	17.046	17.053	17.059	17.066	17.072	17.079	17.085	17.092	<b>2950</b>	17.503	17.510	17.517	17.524	17.531	17.538	17.545	17.552	17.559	17.566	
2960	17.092	17.099	17.105	17.112	17.118	17.125	17.131	17.138	17.144	17.151	17.157	2960	18.503	18.514	18.525	18.535	18.546	18.557	18.567	18.578	18.588	18.599	18.609
2970	17.157	17.164	17.171	17.177	17.184	17.190	17.197	17.203	17.210	17.216	17.223	2970	18.609	18.620	18.630	18.641	18.651	18.661	18.672	18.682	18.693		
2980	17.223	17.229	17.236	17.242	17.249	17.255	17.262	17.268	17.275	17.282	17.288	2980											
2990	17.288	17.295	17.301	17.308	17.314	17.321	17.327	17.334	17.340	17.347	17.353	2990											
<b>3000</b>	17.353	17.360	17.366	17.373	17.379	17.386	17.392	17.399	17.405	17.412	17.418	<b>3000</b>											
3010	17.418	17.425	17.431	17.438	17.444	17.451	17.457	17.464	17.470	17.477	17.483	3010											
3020	17.483	17.490	17.496	17.503	17.509	17.516	17.522	17.529	17.535	17.542	17.548	3020											
3030	17.548	17.555	17.561	17.568	17.574	17.581	17.587	17.594	17.600	17.607	17.613	3030											
3040	17.613	17.620	17.626	17.633	17.639	17.645	17.652	17.658	17.665	17.671	17.678	3040											
<b>3050</b>	17.678	17.684	17.691	17.697	17.704	17.710	17.717	17.723	17.729	17.736	17.742	<b>3050</b>											
3060	17.742	17.749	17.755	17.762	17.768	17.775	17.781	17.787	17.794	17.800	17.807	3060											
3070	17.807	17.813	17.819	17.826	17.832	17.839	17.845	17.852	17.858	17.864	17.871	3070											
3080	17.871	17.877	17.884	17.890	17.896	17.903	17.909	17.915	17.922	17.928	17.935	3080											
3090	17.935	17.941	17.947	17.954	17.960	17.966	17.973	17.979	17.985	17.992	17.998	3090											
<b>3100</b>	17.998	18.004	18.011	18.017	18.023	18.030	18.036	18.042	18.049	18.055	18.061	<b>3100</b>											
3110	18.061	18.068	18.074	18.080	18.086	18.093	18.099	18.105	18.112	18.118	18.124	3110											
3120	18.124	18.130	18.137	18.143	18.149	18.155	18.162	18.168	18.174	18.180	18.187	3120											
3130	18.187	18.193	18.199	18.205	18.211	18.218	18.224	18.230	18.236	18.242	18.249	3130											
3140	18.249	18.255	18.261	18.267	18.273	18.279	18.285	18.292	18.298	18.304	18.310	3140											
<b>3150</b>	18.310	18.316	18.322	18.328	18.334	18.341	18.347	18.353	18.359	18.365	18.371	<b>3150</b>											
3160	18.371	18.377	18.383	18.389	18.395	18.401	18.407	18.413	18.419	18.425	18.431	3160											
3170	18.431	18.437	18.443	18.449	18.455	18.461	18.467	18.473	18.479	18.485	18.491	3170											
3180	18.491	18.497	18.503	18.509	18.515	18.521	18.527	18.533	18.539	18.545	18.551	3180											
3190	18.551	18.557	18.562	18.568	18.574	18.580	18.586	18.592	18.598	18.603	18.609	3190											
<b>3200</b>	18.609	18.615	18.621	18.627	18.633	18.638	18.644	18.650	18.656	18.661	18.667	<b>3200</b>											
3210	18.667	18.673	18.679	18.684	18.690							3210											

S

°F	EMF in Millivolts — Reference Junction 32°F											°F	°C	EMF in Millivolts — Reference Junctions 0 °C											°C	
	0	1	2	3	4	5	6	7	8	9	10			0	1	2	3	4	5	6	7	8	9	10		
30			0.000	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.001	-0.001	30	<b>0</b>	0.000	0.000	0.000	-0.001	-0.001	-0.001	-0.001	-0.001	-0.002	-0.002	-0.002	<b>0</b>	
40	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.002	-0.002	-0.002	-0.002	-0.002	40	10	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.003	-0.003	-0.003	10
<b>50</b>	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	<b>50</b>	20	-0.003	-0.003	-0.003	-0.003	-0.003	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	20
60	-0.002	-0.002	-0.002	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	60	30	-0.002	-0.002	-0.002	-0.002	-0.002	-0.001	-0.001	-0.001	-0.001	-0.001	0.000	0.000	30
70	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.002	-0.002	-0.002	-0.002	70	40	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.002	0.002	40
80	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	80														
90	-0.002	-0.002	-0.002	-0.002	-0.002	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	90														
<b>100</b>	-0.001	-0.001	-0.001	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	<b>100</b>	<b>50</b>	0.002	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.005	0.005	0.006	0.006	<b>50</b>
110	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	110	60	0.006	0.007	0.007	0.008	0.008	0.009	0.009	0.010	0.010	0.011	0.011	0.011	60
120	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.003	0.004	120	70	0.011	0.012	0.012	0.013	0.014	0.014	0.014	0.015	0.015	0.016	0.017	0.017	70
130	0.004	0.004	0.004	0.005	0.005	0.005	0.005	0.005	0.006	0.006	0.006	130	80	0.017	0.018	0.019	0.020	0.020	0.021	0.022	0.022	0.023	0.024	0.025	0.025	80
140	0.006	0.006	0.007	0.007	0.007	0.007	0.008	0.008	0.008	0.009	0.009	140	90	0.025	0.026	0.026	0.027	0.028	0.029	0.030	0.031	0.031	0.032	0.033	0.033	90
<b>150</b>	0.009	0.009	0.009	0.010	0.010	0.010	0.011	0.011	0.011	0.012	0.012	<b>150</b>	<b>100</b>	0.033	0.034	0.035	0.036	0.037	0.038	0.039	0.040	0.041	0.042	0.043	0.043	<b>100</b>
160	0.012	0.012	0.013	0.013	0.013	0.014	0.014	0.014	0.015	0.015	0.015	160	110	0.043	0.044	0.045	0.046	0.047	0.048	0.049	0.050	0.051	0.052	0.053	0.053	110
170	0.015	0.016	0.016	0.016	0.017	0.017	0.017	0.018	0.018	0.019	0.019	170	120	0.053	0.055	0.056	0.057	0.058	0.059	0.060	0.062	0.063	0.064	0.065	0.065	120
180	0.019	0.019	0.020	0.020	0.021	0.021	0.021	0.022	0.022	0.023	0.023	180	130	0.065	0.066	0.068	0.069	0.070	0.072	0.073	0.074	0.075	0.077	0.078	0.078	130
190	0.023	0.023	0.024	0.024	0.025	0.025	0.026	0.026	0.027	0.027	0.027	190	140	0.078	0.079	0.081	0.082	0.084	0.085	0.086	0.088	0.089	0.091	0.092	0.092	140
<b>200</b>	0.027	0.028	0.028	0.029	0.029	0.030	0.030	0.031	0.031	0.032	0.032	<b>200</b>	<b>150</b>	0.092	0.094	0.095	0.096	0.098	0.099	0.101	0.102	0.104	0.106	0.107	0.107	<b>150</b>
210	0.032	0.033	0.033	0.034	0.034	0.035	0.035	0.036	0.036	0.037	0.037	210	160	0.107	0.109	0.110	0.112	0.113	0.115	0.117	0.118	0.120	0.122	0.123	0.123	160
220	0.037	0.038	0.038	0.039	0.039	0.040	0.041	0.041	0.042	0.042	0.043	220	170	0.123	0.125	0.127	0.128	0.130	0.132	0.134	0.135	0.137	0.139	0.141	0.141	170
230	0.043	0.043	0.044	0.044	0.045	0.046	0.046	0.047	0.047	0.048	0.049	230	180	0.141	0.142	0.144	0.146	0.148	0.150	0.151	0.153	0.155	0.157	0.159	0.159	180
240	0.049	0.049	0.050	0.050	0.051	0.052	0.052	0.053	0.053	0.054	0.055	240	190	0.159	0.161	0.163	0.165	0.166	0.168	0.170	0.172	0.174	0.176	0.178	0.178	190
<b>250</b>	0.055	0.055	0.056	0.057	0.057	0.058	0.059	0.059	0.060	0.060	0.061	<b>250</b>	<b>200</b>	0.178	0.180	0.182	0.184	0.186	0.188	0.190	0.192	0.195	0.197	0.199	0.199	<b>200</b>
260	0.061	0.062	0.062	0.063	0.064	0.065	0.065	0.066	0.067	0.067	0.068	260	210	0.199	0.201	0.203	0.205	0.207	0.209	0.212	0.214	0.216	0.218	0.220	0.220	210
270	0.068	0.069	0.069	0.070	0.071	0.072	0.072	0.073	0.074	0.074	0.075	270	220	0.220	0.222	0.225	0.227	0.229	0.231	0.234	0.236	0.238	0.241	0.243	0.243	220
280	0.075	0.076	0.077	0.077	0.078	0.079	0.080	0.080	0.081	0.082	0.083	280	230	0.243	0.245	0.248	0.250	0.252	0.255	0.257	0.259	0.262	0.264	0.267	0.267	230
290	0.083	0.083	0.084	0.085	0.086	0.086	0.087	0.088	0.089	0.090	0.090	290	240	0.267	0.269	0.271	0.274	0.276	0.279	0.281	0.284	0.286	0.289	0.291	0.291	240
<b>300</b>	0.090	0.091	0.092	0.093	0.094	0.094	0.095	0.096	0.097	0.098	0.099	<b>300</b>	<b>250</b>	0.291	0.294	0.296	0.299	0.301	0.304	0.307	0.309	0.312	0.314	0.317	0.317	<b>250</b>
310	0.099	0.099	0.100	0.101	0.102	0.103	0.104	0.105	0.105	0.106	0.107	310	260	0.317	0.320	0.322	0.325	0.328	0.330	0.333	0.336	0.338	0.341	0.344	0.344	260
320	0.107	0.108	0.109	0.110	0.111	0.112	0.112	0.113	0.114	0.115	0.116	320	270	0.344	0.347	0.349	0.352	0.355	0.358	0.360	0.363	0.366	0.369	0.372	0.372	270
330	0.116	0.117	0.118	0.119	0.120	0.121	0.121	0.122	0.123	0.124	0.125	330	280	0.372	0.375	0.377	0.380	0.383	0.386	0.389	0.392	0.395	0.398	0.401	0.401	280
340	0.125	0.126	0.127	0.128	0.129	0.130	0.131	0.132	0.133	0.134	0.135	340	290	0.401	0.404	0.407	0.410	0.413	0.416	0.419	0.422	0.425	0.428	0.431	0.431	290
<b>350</b>	0.135	0.136	0.137	0.138	0.139	0.140	0.141	0.142	0.143	0.144	0.145	<b>350</b>	<b>200</b>	0.178	0.180	0.182	0.184	0.186	0.188	0.190	0.192	0.195	0.197	0.199	0.199	<b>200</b>
360	0.145	0.146	0.147	0.148	0.149	0.150	0.151	0.152	0.153	0.154	0.155	360	210	0.199	0.201	0.203	0.205	0.207	0.209	0.212	0.214	0.216	0.218	0.220	0.220	210
370	0.155	0.156	0.157	0.158	0.159	0.160	0.161	0.162	0.163	0.164	0.165	370	220	0.220	0.222	0.225	0.227	0.229	0.231	0.234	0.236	0.238	0.241	0.243	0.243	220
380	0.165	0.166	0.167	0.168	0.170	0.171	0.172	0.173	0.174	0.175	0.176	380	230	0.243	0.245	0.248	0.250	0.252	0.255	0.257	0.259	0.262	0.264	0.267	0.267	230
390	0.176	0.177	0.178	0.179	0.180	0.182	0.183	0.184	0.185	0.186	0.187	390	240	0.267	0.269	0.271	0.274	0.276	0.279	0.281	0.284	0.286	0.289	0.291	0.291	240
<b>400</b>	0.187	0.188	0.190	0.191	0.192	0.193	0.194	0.195	0.196	0.198	0.199	<b>400</b>	<b>250</b>	0.291	0.294	0.296	0.299	0.301	0.304	0.307	0.309	0.312	0.314	0.317	0.317	<b>250</b>
410	0.199	0.200	0.201	0.202	0.203	0.205	0.206	0.207	0.208	0.209	0.211	410	260	0.317	0.320	0.322	0.325	0.328	0.330	0.333	0.336	0.338	0.341	0.344	0.344	260
420	0.211	0.212	0.213	0.214	0.215	0.217	0.218	0.219	0.220	0.222	0.223	420	270	0.344	0.347	0.349	0.352	0.355	0.358	0.360	0.363	0.366	0.369	0.372	0.372	270
430	0.223	0.224	0.225	0.226	0.228	0.229	0.230	0.231	0.233	0.234	0.235	430	280	0.372	0.375	0.377	0.380	0.383	0.386	0.389	0.392	0.395	0.398	0.401	0.401	280
440	0.235	0.236	0.238	0.239	0.240	0.242	0.243	0.244	0.245	0.247	0.248	440	290	0.401	0.404	0.407	0.410	0.413	0.416	0.419	0.422	0.425	0.428	0.431	0.431	290
<b>450</b>	0.248	0.249	0.251	0.252	0.253	0.255	0.256	0.257	0.259	0.260	0.261	<b>450</b>	<b>200</b>	0.178	0.180	0.182	0.184	0.186	0.188	0.190	0.192	0.195	0.197	0.199	0.199	<b>200</b>
460	0.261	0.263	0.264	0.265	0.267	0.268	0.269	0.271	0.272	0.273	0.275	460	210	0.199	0.201	0.203	0.205	0.207	0.209	0.212	0.214	0.216	0.218	0.220	0.220	210
470	0.275	0.276	0.277	0.279	0.280	0.282	0.283	0.284	0.286	0.287	0.288	470	220	0.220	0.222	0.225	0.227	0.229	0.231	0.234	0.236	0.238	0.241	0.243	0.243	220
480	0.288																									



500 °F - 1000 °F

Type B - PT 30% RH vs PT 6% RH

300 °C - 600 °C

°F	0	1	2	3	4	5	6	7	8	9	10	°F	°C	0	1	2	3	4	5	6	7	8	9	10	°C
	EMF in Millivolts — Reference Junction 32°F												EMF in Millivolts — Reference Junctions 0 °C												
500	0.317	0.319	0.320	0.321	0.323	0.324	0.326	0.327	0.329	0.330	0.332	500	300	0.431	0.434	0.437	0.440	0.443	0.446	0.449	0.452	0.455	0.458	0.462	300
510	0.332	0.333	0.335	0.336	0.338	0.339	0.341	0.342	0.344	0.345	0.347	510	310	0.462	0.465	0.468	0.471	0.474	0.478	0.481	0.484	0.487	0.490	0.494	310
520	0.347	0.348	0.350	0.352	0.353	0.355	0.356	0.358	0.359	0.361	0.362	520	320	0.494	0.497	0.500	0.503	0.507	0.510	0.513	0.517	0.520	0.523	0.527	320
530	0.362	0.364	0.365	0.367	0.369	0.370	0.372	0.373	0.375	0.377	0.378	530	330	0.527	0.530	0.533	0.537	0.540	0.544	0.547	0.550	0.554	0.557	0.561	330
540	0.378	0.380	0.381	0.383	0.384	0.386	0.388	0.389	0.391	0.393	0.394	540	340	0.561	0.564	0.568	0.571	0.575	0.578	0.582	0.585	0.589	0.592	0.596	340
550	0.394	0.396	0.397	0.399	0.401	0.402	0.404	0.406	0.407	0.409	0.411	550	350	0.596	0.599	0.603	0.607	0.610	0.614	0.617	0.621	0.625	0.628	0.632	350
560	0.411	0.412	0.414	0.416	0.417	0.419	0.421	0.422	0.424	0.426	0.427	560	360	0.632	0.636	0.639	0.643	0.647	0.650	0.654	0.658	0.662	0.665	0.669	360
570	0.427	0.429	0.431	0.432	0.434	0.436	0.437	0.439	0.441	0.443	0.444	570	370	0.669	0.673	0.677	0.680	0.684	0.688	0.692	0.696	0.700	0.703	0.707	370
580	0.444	0.446	0.448	0.449	0.451	0.453	0.455	0.456	0.458	0.460	0.462	580	380	0.707	0.711	0.715	0.719	0.723	0.727	0.731	0.735	0.738	0.742	0.746	380
590	0.462	0.463	0.465	0.467	0.469	0.470	0.472	0.474	0.476	0.478	0.479	590	390	0.746	0.750	0.754	0.758	0.762	0.766	0.770	0.774	0.778	0.782	0.787	390
600	0.479	0.481	0.483	0.485	0.486	0.488	0.490	0.492	0.494	0.495	0.497	600	400	0.787	0.791	0.795	0.799	0.803	0.807	0.811	0.815	0.819	0.824	0.828	400
610	0.497	0.499	0.501	0.503	0.505	0.506	0.508	0.510	0.512	0.514	0.516	610	410	0.828	0.832	0.836	0.840	0.844	0.849	0.853	0.857	0.861	0.866	0.870	410
620	0.516	0.517	0.519	0.521	0.523	0.525	0.527	0.529	0.530	0.532	0.534	620	420	0.870	0.874	0.878	0.883	0.887	0.891	0.896	0.900	0.904	0.909	0.913	420
630	0.534	0.536	0.538	0.540	0.542	0.544	0.546	0.547	0.549	0.551	0.553	630	430	0.913	0.917	0.922	0.926	0.930	0.935	0.939	0.944	0.948	0.953	0.957	430
640	0.553	0.555	0.557	0.559	0.561	0.563	0.565	0.567	0.569	0.570	0.572	640	440	0.957	0.961	0.966	0.970	0.975	0.979	0.984	0.988	0.993	0.997	1.002	440
650	0.572	0.574	0.576	0.578	0.580	0.582	0.584	0.586	0.588	0.590	0.592	650	450	1.002	1.007	1.011	1.016	1.020	1.025	1.030	1.034	1.039	1.043	1.048	450
660	0.592	0.594	0.596	0.598	0.600	0.602	0.604	0.606	0.608	0.610	0.612	660	460	1.048	1.053	1.057	1.062	1.067	1.071	1.076	1.081	1.086	1.090	1.095	460
670	0.612	0.614	0.616	0.618	0.620	0.622	0.624	0.626	0.628	0.630	0.632	670	470	1.095	1.100	1.105	1.109	1.114	1.119	1.124	1.129	1.133	1.138	1.143	470
680	0.632	0.634	0.636	0.638	0.640	0.642	0.644	0.646	0.648	0.650	0.653	680	480	1.143	1.148	1.153	1.158	1.163	1.167	1.172	1.177	1.182	1.187	1.192	480
690	0.653	0.655	0.657	0.659	0.661	0.663	0.665	0.667	0.669	0.671	0.673	690	490	1.192	1.197	1.202	1.207	1.212	1.217	1.222	1.227	1.232	1.237	1.242	490
700	0.673	0.675	0.678	0.680	0.682	0.684	0.686	0.688	0.690	0.692	0.694	700	500	1.242	1.247	1.252	1.257	1.262	1.267	1.272	1.277	1.282	1.288	1.293	500
710	0.694	0.697	0.699	0.701	0.703	0.705	0.707	0.709	0.712	0.714	0.716	710	510	1.293	1.298	1.303	1.308	1.313	1.318	1.324	1.329	1.334	1.339	1.344	510
720	0.716	0.718	0.720	0.722	0.725	0.727	0.729	0.731	0.733	0.735	0.738	720	520	1.344	1.350	1.355	1.360	1.365	1.371	1.376	1.381	1.387	1.392	1.397	520
730	0.738	0.740	0.742	0.744	0.746	0.749	0.751	0.753	0.755	0.757	0.760	730	530	1.397	1.402	1.408	1.413	1.418	1.424	1.429	1.435	1.440	1.445	1.451	530
740	0.760	0.762	0.764	0.766	0.769	0.771	0.773	0.775	0.778	0.780	0.782	740	540	1.451	1.456	1.462	1.467	1.472	1.478	1.483	1.489	1.494	1.500	1.505	540
750	0.782	0.784	0.787	0.789	0.791	0.793	0.796	0.798	0.800	0.802	0.805	750	550	1.505	1.511	1.516	1.522	1.527	1.533	1.539	1.544	1.550	1.555	1.561	550
760	0.805	0.807	0.809	0.812	0.814	0.816	0.818	0.821	0.823	0.825	0.828	760	560	1.561	1.566	1.572	1.578	1.583	1.589	1.595	1.600	1.606	1.612	1.617	560
770	0.828	0.830	0.832	0.835	0.837	0.839	0.842	0.844	0.846	0.849	0.851	770	570	1.617	1.623	1.629	1.634	1.640	1.646	1.652	1.657	1.663	1.669	1.675	570
780	0.851	0.853	0.856	0.858	0.860	0.863	0.865	0.867	0.870	0.872	0.875	780	580	1.675	1.680	1.686	1.692	1.698	1.704	1.709	1.715	1.721	1.727	1.733	580
790	0.875	0.877	0.879	0.882	0.884	0.886	0.889	0.891	0.894	0.896	0.898	790	590	1.733	1.739	1.745	1.750	1.756	1.762	1.768	1.774	1.780	1.786	1.792	590
800	0.898	0.901	0.903	0.906	0.908	0.910	0.913	0.915	0.918	0.920	0.923	800													
810	0.923	0.925	0.927	0.930	0.932	0.935	0.937	0.940	0.942	0.945	0.947	810													
820	0.947	0.950	0.952	0.955	0.957	0.959	0.962	0.964	0.967	0.969	0.972	820													
830	0.972	0.974	0.977	0.979	0.982	0.984	0.987	0.989	0.992	0.994	0.997	830													
840	0.997	1.000	1.002	1.005	1.007	1.010	1.012	1.015	1.017	1.020	1.022	840													
850	1.022	1.025	1.027	1.030	1.033	1.035	1.038	1.040	1.043	1.045	1.048	850													
860	1.048	1.051	1.053	1.056	1.058	1.061	1.064	1.066	1.069	1.071	1.074	860													
870	1.074	1.077	1.079	1.082	1.085	1.087	1.090	1.092	1.095	1.098	1.100	870													
880	1.100	1.103	1.106	1.108	1.111	1.114	1.116	1.119	1.122	1.124	1.127	880													
890	1.127	1.130	1.132	1.135	1.138	1.140	1.143	1.146	1.148	1.151	1.154	890													
900	1.154	1.157	1.159	1.162	1.165	1.167	1.170	1.173	1.176	1.178	1.181	900													
910	1.181	1.184	1.186	1.189	1.192	1.195	1.197	1.200	1.203	1.206	1.208	910													
920	1.208	1.211	1.214	1.217	1.220	1.222	1.225	1.228	1.231	1.233	1.236	920													
930	1.236	1.239	1.242	1.245	1.247	1.250	1.253	1.256	1.259	1.262	1.264	930													
940	1.264	1.267	1.270	1.273	1.276	1.278	1.281	1.284	1.287	1.290	1.293	940													
950	1.293	1.296	1.298	1.301	1.304	1.307	1.310	1.313	1.316	1.318	1.321	950													
960	1.321	1.324	1.327	1.330	1.333	1.336	1.339	1.342	1.344	1.347	1.350	960													
970	1.350	1.353	1.356	1.359	1.362	1.365	1.368	1.371	1.374	1.377	1.379	970													
980	1.379	1.382	1.385	1.388	1.391	1.394	1.397	1.400	1.403	1.406	1.409	980													
990	1.409	1.412	1.415	1.418	1.421	1.424	1.427	1.430	1.433	1.436	1.439	990													

**B**

°F	EMF in Millivolts — Reference Junction 32°F											°F	°C	EMF in Millivolts — Reference Junctions 0 °C											°C
	0	1	2	3	4	5	6	7	8	9	10			0	1	2	3	4	5	6	7	8	9	10	
1000	1.439	1.442	1.445	1.448	1.451	1.454	1.457	1.460	1.463	1.466	1.469	1000	600	1.792	1.798	1.804	1.810	1.816	1.822	1.828	1.834	1.840	1.846	1.852	600
1010	1.469	1.472	1.475	1.478	1.481	1.484	1.487	1.490	1.493	1.496	1.499	1010	610	1.852	1.858	1.864	1.870	1.876	1.882	1.888	1.894	1.901	1.907	1.913	610
1020	1.499	1.502	1.505	1.508	1.511	1.515	1.518	1.521	1.524	1.527	1.530	1020	620	1.913	1.919	1.925	1.931	1.937	1.944	1.950	1.956	1.962	1.968	1.975	620
1030	1.530	1.533	1.536	1.539	1.542	1.545	1.548	1.552	1.555	1.558	1.561	1030	630	1.975	1.981	1.987	1.993	1.999	2.006	2.012	2.018	2.025	2.031	2.037	630
1040	1.561	1.564	1.567	1.570	1.573	1.576	1.580	1.583	1.586	1.589	1.592	1040	640	2.037	2.043	2.050	2.056	2.062	2.069	2.075	2.082	2.088	2.094	2.101	640
1050	1.592	1.595	1.598	1.601	1.605	1.608	1.611	1.614	1.617	1.620	1.624	1050	650	2.101	2.107	2.113	2.120	2.126	2.133	2.139	2.146	2.152	2.158	2.165	650
1060	1.624	1.627	1.630	1.633	1.636	1.639	1.643	1.646	1.649	1.652	1.655	1060	660	2.165	2.171	2.178	2.184	2.191	2.197	2.204	2.210	2.217	2.224	2.230	660
1070	1.655	1.659	1.662	1.665	1.668	1.671	1.675	1.678	1.681	1.684	1.687	1070	670	2.230	2.237	2.243	2.250	2.256	2.263	2.270	2.276	2.283	2.289	2.296	670
1080	1.687	1.691	1.694	1.697	1.700	1.704	1.707	1.710	1.713	1.716	1.720	1080	680	2.296	2.303	2.309	2.316	2.323	2.329	2.336	2.343	2.350	2.356	2.363	680
1090	1.720	1.723	1.726	1.729	1.733	1.736	1.739	1.743	1.746	1.749	1.752	1090	690	2.363	2.370	2.376	2.383	2.390	2.397	2.403	2.410	2.417	2.424	2.431	690
1100	1.752	1.756	1.759	1.762	1.765	1.769	1.772	1.775	1.779	1.782	1.785	1100	700	2.431	2.437	2.444	2.451	2.458	2.465	2.472	2.479	2.485	2.492	2.499	700
1110	1.785	1.789	1.792	1.795	1.798	1.802	1.805	1.808	1.812	1.815	1.818	1110	710	2.499	2.506	2.513	2.520	2.527	2.534	2.541	2.548	2.555	2.562	2.569	710
1120	1.818	1.822	1.825	1.828	1.832	1.835	1.838	1.842	1.845	1.849	1.852	1120	720	2.569	2.576	2.583	2.590	2.597	2.604	2.611	2.618	2.625	2.632	2.639	720
1130	1.852	1.855	1.859	1.862	1.865	1.869	1.872	1.875	1.879	1.882	1.886	1130	730	2.639	2.646	2.653	2.660	2.667	2.674	2.681	2.688	2.696	2.703	2.710	730
1140	1.886	1.889	1.892	1.896	1.899	1.903	1.906	1.909	1.913	1.916	1.920	1140	740	2.710	2.717	2.724	2.731	2.738	2.746	2.753	2.760	2.767	2.775	2.782	740
1150	1.920	1.923	1.926	1.930	1.933	1.937	1.940	1.944	1.947	1.950	1.954	1150	750	2.782	2.789	2.796	2.803	2.811	2.818	2.825	2.833	2.840	2.847	2.854	750
1160	1.954	1.957	1.961	1.964	1.968	1.971	1.975	1.978	1.981	1.985	1.988	1160	760	2.854	2.862	2.869	2.876	2.884	2.891	2.898	2.906	2.913	2.921	2.928	760
1170	1.988	1.992	1.995	1.999	2.002	2.006	2.009	2.013	2.016	2.020	2.023	1170	770	2.928	2.935	2.943	2.950	2.958	2.965	2.973	2.980	2.987	2.995	3.002	770
1180	2.023	2.027	2.030	2.034	2.037	2.041	2.044	2.048	2.051	2.055	2.058	1180	780	3.002	3.010	3.017	3.025	3.032	3.040	3.047	3.055	3.062	3.070	3.078	780
1190	2.058	2.062	2.065	2.069	2.072	2.076	2.079	2.083	2.086	2.090	2.094	1190	790	3.078	3.085	3.093	3.100	3.108	3.116	3.123	3.131	3.138	3.146	3.154	790
1200	2.094	2.097	2.101	2.104	2.108	2.111	2.115	2.118	2.122	2.126	2.129	1200	800	3.154	3.161	3.169	3.177	3.184	3.192	3.200	3.207	3.215	3.223	3.230	800
1210	2.129	2.133	2.136	2.140	2.143	2.147	2.151	2.154	2.158	2.161	2.165	1210	810	3.230	3.238	3.246	3.254	3.261	3.269	3.277	3.285	3.292	3.300	3.308	810
1220	2.165	2.169	2.172	2.176	2.179	2.183	2.187	2.190	2.194	2.197	2.201	1220	820	3.308	3.316	3.324	3.331	3.339	3.347	3.355	3.363	3.371	3.379	3.386	820
1230	2.201	2.205	2.208	2.212	2.216	2.219	2.223	2.226	2.230	2.234	2.237	1230	830	3.386	3.394	3.402	3.410	3.418	3.426	3.434	3.442	3.450	3.458	3.466	830
1240	2.237	2.241	2.245	2.248	2.252	2.256	2.259	2.263	2.267	2.270	2.274	1240	840	3.466	3.474	3.482	3.490	3.498	3.506	3.514	3.522	3.530	3.538	3.546	840
1250	2.274	2.278	2.281	2.285	2.289	2.292	2.296	2.300	2.303	2.307	2.311	1250	850	3.546	3.554	3.562	3.570	3.578	3.586	3.594	3.602	3.610	3.618	3.626	850
1260	2.311	2.315	2.318	2.322	2.326	2.329	2.333	2.337	2.341	2.344	2.348	1260	860	3.626	3.634	3.643	3.651	3.659	3.667	3.675	3.683	3.692	3.700	3.708	860
1270	2.348	2.352	2.355	2.359	2.363	2.367	2.370	2.374	2.378	2.382	2.385	1270	870	3.708	3.716	3.724	3.732	3.741	3.749	3.757	3.765	3.774	3.782	3.790	870
1280	2.385	2.389	2.393	2.397	2.400	2.404	2.408	2.412	2.416	2.419	2.423	1280	880	3.790	3.798	3.807	3.815	3.823	3.832	3.840	3.848	3.857	3.865	3.873	880
1290	2.423	2.427	2.431	2.434	2.438	2.442	2.446	2.450	2.453	2.457	2.461	1290	890	3.873	3.882	3.890	3.898	3.907	3.915	3.923	3.932	3.940	3.949	3.957	890
1300	2.461	2.465	2.469	2.472	2.476	2.480	2.484	2.488	2.492	2.495	2.499	1300													
1310	2.499	2.503	2.507	2.511	2.515	2.518	2.522	2.526	2.530	2.534	2.538	1310													
1320	2.538	2.541	2.545	2.549	2.553	2.557	2.561	2.565	2.569	2.572	2.576	1320													
1330	2.576	2.580	2.584	2.588	2.592	2.596	2.600	2.604	2.607	2.611	2.615	1330													
1340	2.615	2.619	2.623	2.627	2.631	2.635	2.639	2.643	2.647	2.651	2.654	1340													
1350	2.654	2.658	2.662	2.666	2.670	2.674	2.678	2.682	2.686	2.690	2.694	1350													
1360	2.694	2.698	2.702	2.706	2.710	2.714	2.718	2.722	2.726	2.730	2.734	1360													
1370	2.734	2.738	2.742	2.746	2.750	2.754	2.758	2.762	2.766	2.770	2.774	1370													
1380	2.774	2.778	2.782	2.786	2.790	2.794	2.798	2.802	2.806	2.810	2.814	1380													
1390	2.814	2.818	2.822	2.826	2.830	2.834	2.838	2.842	2.846	2.850	2.854	1390													
1400	2.854	2.859	2.863	2.867	2.871	2.875	2.879	2.883	2.887	2.891	2.895	1400													
1410	2.895	2.899	2.903	2.908	2.912	2.916	2.920	2.924	2.928	2.932	2.936	1410													
1420	2.936	2.940	2.944	2.949	2.953	2.957	2.961	2.965	2.969	2.973	2.978	1420													
1430	2.978	2.982	2.986	2.990	2.994	2.998	3.002	3.007	3.011	3.015	3.019	1430													
1440	3.019	3.023	3.027	3.032	3.036	3.040	3.044	3.048	3.052	3.057	3.061	1440													
1450	3.061	3.065	3.069	3.073	3.078	3.082	3.086	3.090	3.094	3.099	3.103	1450													
1460	3.103	3.107	3.111	3.116	3.120	3.124	3.128	3.132	3.137	3.141	3.145	1460													
1470	3.145	3.149	3.154	3.158	3.162	3.166	3.171	3.175	3.179	3.183	3.188	1470													
1480	3.188	3.192	3.196	3.200	3.205	3.209	3.213	3.218	3.222	3.226	3.230	1480													
1490	3.230	3.235	3.239	3.243	3.248	3.252	3.256	3.261	3.265	3.269	3.273	1490													





2500 °F - 3000 °F

Type B - PT 30% RH vs PT 6% RH

1500 °C - 1800 °C

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°F	0	1	2	3	4	5	6	7	8	9	10	°F	°C	0	1	2	3	4	5	6	7	8	9	10	°C
	EMF in Millivolts — Reference Junction 32°F													EMF in Millivolts — Reference Junctions 0 °C											
<b>2500</b>	8.632	8.638	8.644	8.651	8.657	8.663	8.669	8.675	8.682	8.688	8.694	<b>2500</b>	<b>1500</b>	10.099	10.111	10.122	10.134	10.145	10.157	10.168	10.180	10.192	10.203	10.215	<b>1500</b>
2510	8.694	8.700	8.707	8.713	8.719	8.725	8.731	8.738	8.744	8.750	8.756	2510	1510	10.215	10.226	10.238	10.249	10.261	10.273	10.284	10.296	10.307	10.319	10.331	1510
2520	8.756	8.763	8.769	8.775	8.781	8.787	8.794	8.800	8.806	8.812	8.819	2520	1520	10.331	10.342	10.354	10.365	10.377	10.389	10.400	10.412	10.423	10.435	10.447	1520
2530	8.819	8.825	8.831	8.837	8.844	8.850	8.856	8.862	8.869	8.875	8.881	2530	1530	10.447	10.458	10.470	10.482	10.493	10.505	10.516	10.528	10.540	10.551	10.563	1530
2540	8.881	8.887	8.894	8.900	8.906	8.912	8.919	8.925	8.931	8.937	8.944	2540	1540	10.563	10.575	10.586	10.598	10.609	10.621	10.633	10.644	10.656	10.668	10.679	1540
<b>2550</b>	8.944	8.950	8.956	8.962	8.969	8.975	8.981	8.988	8.994	9.000	9.006	<b>2550</b>	<b>1550</b>	10.679	10.691	10.703	10.714	10.726	10.738	10.749	10.761	10.773	10.784	10.796	<b>1550</b>
2560	9.006	9.013	9.019	9.025	9.031	9.038	9.044	9.050	9.057	9.063	9.069	2560	1560	10.796	10.808	10.819	10.831	10.843	10.854	10.866	10.877	10.889	10.901	10.913	1560
2570	9.069	9.075	9.082	9.088	9.094	9.101	9.107	9.113	9.119	9.126	9.132	2570	1570	10.913	10.924	10.936	10.948	10.959	10.971	10.983	10.994	11.006	11.018	11.029	1570
2580	9.132	9.138	9.145	9.151	9.157	9.164	9.170	9.176	9.182	9.189	9.195	2580	1580	11.029	11.041	11.053	11.064	11.076	11.088	11.099	11.111	11.123	11.134	11.146	1580
2590	9.195	9.201	9.208	9.214	9.220	9.227	9.233	9.239	9.245	9.252	9.258	2590	1590	11.146	11.158	11.169	11.181	11.193	11.205	11.216	11.228	11.240	11.251	11.263	1590
<b>2600</b>	9.258	9.264	9.271	9.277	9.283	9.290	9.296	9.302	9.309	9.315	9.321	<b>2600</b>	<b>1600</b>	11.263	11.275	11.286	11.298	11.310	11.321	11.333	11.345	11.357	11.368	11.380	<b>1600</b>
2610	9.321	9.328	9.334	9.340	9.347	9.353	9.359	9.366	9.372	9.378	9.385	2610	1610	11.380	11.392	11.403	11.415	11.427	11.438	11.450	11.462	11.474	11.485	11.497	1610
2620	9.385	9.391	9.397	9.404	9.410	9.416	9.423	9.429	9.435	9.442	9.448	2620	1620	11.497	11.509	11.520	11.532	11.544	11.555	11.567	11.579	11.591	11.602	11.614	1620
2630	9.448	9.454	9.461	9.467	9.473	9.480	9.486	9.492	9.499	9.505	9.511	2630	1630	11.614	11.626	11.637	11.649	11.661	11.673	11.684	11.696	11.708	11.719	11.731	1630
2640	9.511	9.518	9.524	9.530	9.537	9.543	9.550	9.556	9.562	9.569	9.575	2640	1640	11.731	11.743	11.754	11.766	11.778	11.790	11.801	11.813	11.825	11.836	11.848	1640
<b>2650</b>	9.575	9.581	9.588	9.594	9.600	9.607	9.613	9.619	9.626	9.632	9.639	<b>2650</b>	<b>1650</b>	11.848	11.860	11.871	11.883	11.895	11.907	11.918	11.930	11.942	11.953	11.965	<b>1650</b>
2660	9.639	9.645	9.651	9.658	9.664	9.670	9.677	9.683	9.690	9.696	9.702	2660	1660	11.965	11.977	11.988	12.000	12.012	12.024	12.035	12.047	12.059	12.070	12.082	1660
2670	9.702	9.709	9.715	9.721	9.728	9.734	9.741	9.747	9.753	9.760	9.766	2670	1670	12.082	12.094	12.105	12.117	12.129	12.141	12.152	12.164	12.176	12.187	12.199	1670
2680	9.766	9.772	9.779	9.785	9.792	9.798	9.804	9.811	9.817	9.824	9.830	2680	1680	12.199	12.211	12.222	12.234	12.246	12.257	12.269	12.281	12.292	12.304	12.316	1680
2690	9.830	9.836	9.843	9.849	9.856	9.862	9.868	9.875	9.881	9.888	9.894	2690	1690	12.316	12.327	12.339	12.351	12.363	12.374	12.386	12.398	12.409	12.421	12.433	1690
<b>2700</b>	9.894	9.900	9.907	9.913	9.920	9.926	9.932	9.939	9.945	9.952	9.958	<b>2700</b>	<b>1700</b>	12.433	12.444	12.456	12.468	12.479	12.491	12.503	12.514	12.526	12.538	12.549	<b>1700</b>
2710	9.958	9.964	9.971	9.977	9.984	9.990	9.996	10.003	10.009	10.016	10.022	2710	1710	12.549	12.561	12.572	12.584	12.596	12.607	12.619	12.631	12.642	12.654	12.666	1710
2720	10.022	10.028	10.035	10.041	10.048	10.054	10.061	10.067	10.073	10.080	10.086	2720	1720	12.666	12.677	12.689	12.701	12.712	12.724	12.736	12.747	12.759	12.770	12.782	1720
2730	10.086	10.093	10.099	10.105	10.112	10.118	10.125	10.131	10.138	10.144	10.150	2730	1730	12.782	12.794	12.805	12.817	12.829	12.840	12.852	12.863	12.875	12.887	12.898	1730
2740	10.150	10.157	10.163	10.170	10.176	10.183	10.189	10.195	10.202	10.208	10.215	2740	1740	12.898	12.910	12.921	12.933	12.945	12.956	12.968	12.980	12.991	13.003	13.014	1740
<b>2750</b>	10.215	10.221	10.228	10.234	10.240	10.247	10.253	10.260	10.266	10.273	10.279	<b>2750</b>	<b>1750</b>	13.014	13.026	13.037	13.049	13.061	13.072	13.084	13.095	13.107	13.119	13.130	<b>1750</b>
2760	10.279	10.286	10.292	10.298	10.305	10.311	10.318	10.324	10.331	10.337	10.344	2760	1760	13.130	13.142	13.153	13.165	13.176	13.188	13.200	13.211	13.223	13.234	13.246	1760
2770	10.344	10.350	10.356	10.363	10.369	10.376	10.382	10.389	10.395	10.402	10.408	2770	1770	13.246	13.257	13.269	13.280	13.292	13.304	13.315	13.327	13.338	13.350	13.361	1770
2780	10.408	10.414	10.421	10.427	10.434	10.440	10.447	10.453	10.460	10.466	10.473	2780	1780	13.361	13.373	13.384	13.396	13.407	13.419	13.430	13.442	13.453	13.465	13.476	1780
2790	10.473	10.479	10.485	10.492	10.498	10.505	10.511	10.518	10.524	10.531	10.537	2790	1790	13.476	13.488	13.499	13.511	13.522	13.534	13.545	13.557	13.568	13.580	13.591	1790
<b>2800</b>	10.537	10.544	10.550	10.556	10.563	10.569	10.576	10.582	10.589	10.595	10.602	<b>2800</b>	<b>1700</b>	12.433	12.444	12.456	12.468	12.479	12.491	12.503	12.514	12.526	12.538	12.549	<b>1700</b>
2810	10.602	10.608	10.615	10.621	10.628	10.634	10.641	10.647	10.653	10.660	10.666	2810	1710	12.549	12.561	12.572	12.584	12.596	12.607	12.619	12.631	12.642	12.654	12.666	1710
2820	10.666	10.673	10.679	10.686	10.692	10.699	10.705	10.712	10.718	10.725	10.731	2820	1720	12.666	12.677	12.689	12.701	12.712	12.724	12.736	12.747	12.759	12.770	12.782	1720
2830	10.731	10.738	10.744	10.751	10.757	10.763	10.770	10.776	10.783	10.789	10.796	2830	1730	12.782	12.794	12.805	12.817	12.829	12.840	12.852	12.863	12.875	12.887	12.898	1730
2840	10.796	10.802	10.809	10.815	10.822	10.828	10.835	10.841	10.848	10.854	10.861	2840	1740	12.898	12.910	12.921	12.933	12.945	12.956	12.968	12.980	12.991	13.003	13.014	1740
<b>2850</b>	10.861	10.867	10.874	10.880	10.887	10.893	10.900	10.906	10.913	10.919	10.925	<b>2850</b>	<b>1750</b>	13.014	13.026	13.037	13.049	13.061	13.072	13.084	13.095	13.107	13.119	13.130	<b>1750</b>
2860	10.925	10.932	10.938	10.945	10.951	10.958	10.964	10.971	10.977	10.984	10.990	2860	1760	13.130	13.142	13.153	13.165	13.176	13.188	13.200	13.211	13.223	13.234	13.246	1760
2870	10.990	10.997	11.003	11.010	11.016	11.023	11.029	11.036	11.042	11.049	11.055	2870	1770	13.246	13.257	13.269	13.280	13.292	13.304	13.315	13.327	13.338	13.350	13.361	1770
2880	11.055	11.062	11.068	11.075	11.081	11.088	11.094	11.101	11.107	11.114	11.120	2880													

3000 °F - 3308 °F

Type B - PT 30% RH vs PT 6% RH

1800 °C - 1820 °C

EMF in Millivolts — Reference Junction 32°F											EMF in Millivolts — Reference Junctions 0 °C														
°F	0	1	2	3	4	5	6	7	8	9	10	°F	°C	0	1	2	3	4	5	6	7	8	9	10	°C
<b>3000</b>	11.835	11.842	11.848	11.855	11.861	11.868	11.874	11.881	11.887	11.894	11.900	<b>3000</b>	<b>1800</b>	13.591	13.603	13.614	13.626	13.637	13.649	13.660	13.672	13.683	13.694	13.706	<b>1800</b>
3010	11.900	11.907	11.913	11.920	11.926	11.933	11.939	11.946	11.952	11.959	11.965	3010	1810	13.706	13.717	13.729	13.740	13.752	13.763	13.775	13.786	13.797	13.809	13.820	1810
3020	11.965	11.972	11.978	11.985	11.991	11.998	12.004	12.011	12.017	12.024	12.030	3020	1820	13.820											1820
3030	12.030	12.037	12.043	12.050	12.056	12.063	12.069	12.076	12.082	12.089	12.095														
3040	12.095	12.102	12.108	12.115	12.121	12.128	12.134	12.141	12.147	12.154	12.160														
<b>3050</b>	12.160	12.166	12.173	12.179	12.186	12.192	12.199	12.205	12.212	12.218	12.225	<b>3050</b>													
3060	12.225	12.231	12.238	12.244	12.251	12.257	12.264	12.270	12.277	12.283	12.290	3060													
3070	12.290	12.296	12.303	12.309	12.316	12.322	12.329	12.335	12.342	12.348	12.355	3070													
3080	12.355	12.361	12.368	12.374	12.381	12.387	12.394	12.400	12.407	12.413	12.420	3080													
3090	12.420	12.426	12.433	12.439	12.446	12.452	12.458	12.465	12.471	12.478	12.484	3090													
<b>3100</b>	12.484	12.491	12.497	12.504	12.510	12.517	12.523	12.530	12.536	12.543	12.549	<b>3100</b>													
3110	12.549	12.556	12.562	12.569	12.575	12.582	12.588	12.595	12.601	12.607	12.614	3110													
3120	12.614	12.620	12.627	12.633	12.640	12.646	12.653	12.659	12.666	12.672	12.679	3120													
3130	12.679	12.685	12.692	12.698	12.704	12.711	12.717	12.724	12.730	12.737	12.743	3130													
3140	12.743	12.750	12.756	12.763	12.769	12.776	12.782	12.789	12.795	12.801	12.808	3140													
<b>3150</b>	12.808	12.814	12.821	12.827	12.834	12.840	12.847	12.853	12.860	12.866	12.872	<b>3150</b>													
3160	12.872	12.879	12.885	12.892	12.898	12.905	12.911	12.918	12.924	12.931	12.937	3160													
3170	12.937	12.943	12.950	12.956	12.963	12.969	12.976	12.982	12.989	12.995	13.001	3170													
3180	13.001	13.008	13.014	13.021	13.027	13.034	13.040	13.047	13.053	13.059	13.066	3180													
3190	13.066	13.072	13.079	13.085	13.092	13.098	13.104	13.111	13.117	13.124	13.130	3190													
<b>3200</b>	13.130	13.137	13.143	13.149	13.156	13.162	13.169	13.175	13.182	13.188	13.194	<b>3200</b>													
3210	13.194	13.201	13.207	13.214	13.220	13.227	13.233	13.239	13.246	13.252	13.259	3210													
3220	13.259	13.265	13.271	13.278	13.284	13.291	13.297	13.304	13.310	13.316	13.323	3220													
3230	13.323	13.329	13.336	13.342	13.348	13.355	13.361	13.368	13.374	13.380	13.387	3230													
3240	13.387	13.393	13.400	13.406	13.412	13.419	13.425	13.432	13.438	13.444	13.451	3240													
<b>3250</b>	13.451	13.457	13.464	13.470	13.476	13.483	13.489	13.496	13.502	13.508	13.515	<b>3250</b>													
3260	13.515	13.521	13.527	13.534	13.540	13.547	13.553	13.559	13.566	13.572	13.579	3260													
3270	13.579	13.585	13.591	13.598	13.604	13.610	13.617	13.623	13.630	13.636	13.642	3270													
3280	13.642	13.649	13.655	13.661	13.668	13.674	13.680	13.687	13.693	13.700	13.706	3280													
3290	13.706	13.712	13.719	13.725	13.731	13.738	13.744	13.750	13.757	13.763	13.769	3290													
<b>3300</b>	13.769	13.776	13.782	13.789	13.795	13.801	13.808	13.814	13.820			<b>3300</b>													

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**B**

# Resistance Temperature Table

Platinum Resistance at 0° C – 100 ohms | Temperature Coefficient – .00385 ohms/ohm °C

°C	0	1	2	3	4	5	6	7	8	9	10	°C
<b>-200</b>	18.52											<b>-200</b>
-190	22.83	22.40	21.97	21.54	21.11	20.68	20.25	19.82	19.38	18.95	18.52	-190
-180	27.10	26.67	26.24	25.82	25.39	24.97	24.54	24.11	23.68	23.25	22.83	-180
-170	31.34	30.91	30.49	30.07	29.64	29.22	28.80	28.37	27.95	27.52	27.10	-170
-160	35.54	35.12	34.70	34.28	33.86	33.44	33.02	32.60	32.18	31.76	31.34	-160
<b>-150</b>	39.72	39.31	38.89	38.47	38.05	37.64	37.22	36.80	36.38	35.96	35.54	<b>-150</b>
-140	43.88	43.46	43.05	42.63	42.22	41.80	41.39	40.97	40.56	40.14	39.72	-140
-130	48.00	47.59	47.18	46.77	46.36	45.94	45.53	45.12	44.70	44.29	43.88	-130
-120	52.11	51.70	51.29	50.88	50.47	50.06	49.65	49.24	48.83	48.42	48.00	-120
-110	56.19	55.79	55.38	54.97	54.56	54.15	53.75	53.34	52.93	52.52	52.11	-110
<b>-100</b>	60.26	59.85	59.44	59.04	58.63	58.23	57.82	57.41	57.01	56.60	56.19	<b>-100</b>
-90	64.30	63.90	63.49	63.09	62.68	62.28	61.88	61.47	61.07	60.66	60.26	-90
-80	68.33	67.92	67.52	67.12	66.72	66.31	65.91	65.51	65.11	64.70	64.30	-80
-70	72.33	71.93	71.53	71.13	70.73	70.33	69.93	69.53	69.13	68.73	68.33	-70
-60	76.33	75.93	75.53	75.13	74.73	74.33	73.93	73.53	73.13	72.73	72.33	-60
<b>-50</b>	80.31	79.91	79.51	79.11	78.72	78.32	77.92	77.52	77.12	76.73	76.33	<b>-50</b>
-40	84.27	83.87	83.48	83.08	82.69	82.29	81.89	81.50	81.10	80.70	80.31	-40
-30	88.22	87.83	87.43	87.04	86.64	86.25	85.85	85.46	85.06	84.67	84.27	-30
-20	92.16	91.77	91.37	90.98	90.59	90.19	89.80	89.40	89.01	88.62	88.22	-20
-10	96.09	95.69	95.30	94.91	94.52	94.12	93.73	93.34	92.95	92.55	92.16	-10
<b>0</b>	100.00	99.61	99.22	98.83	98.44	98.04	97.65	97.26	96.87	96.48	96.09	<b>0</b>
<b>0</b>	100.00	100.39	100.78	101.17	101.56	101.95	102.34	102.73	103.12	103.51	103.90	<b>0</b>
10	103.90	104.29	104.68	105.07	105.46	105.85	106.24	106.63	107.02	107.40	107.79	10
20	107.79	108.18	108.57	108.96	109.35	109.73	110.12	110.51	110.90	111.29	111.67	20
30	111.67	112.06	112.45	112.83	113.22	113.61	114.00	114.38	114.77	115.15	115.54	30
40	115.54	115.93	116.31	116.70	117.08	117.47	117.86	118.24	118.63	119.01	119.40	40
<b>50</b>	119.40	119.78	120.17	120.55	120.94	121.32	121.71	122.09	122.47	122.86	123.24	<b>50</b>
60	123.24	123.63	124.01	124.39	124.78	125.16	125.54	125.93	126.31	126.69	127.08	60
70	127.08	127.46	127.84	128.22	128.61	128.99	129.37	129.75	130.13	130.52	130.90	70
80	130.90	131.28	131.66	132.04	132.42	132.80	133.18	133.57	133.95	134.33	134.71	80
90	134.71	135.09	135.47	135.85	136.23	136.61	136.99	137.37	137.75	138.13	138.51	90
<b>100</b>	138.51	138.88	139.26	139.64	140.02	140.40	140.78	141.16	141.54	141.91	142.29	<b>100</b>
110	142.29	142.67	143.05	143.43	143.80	144.18	144.56	144.94	145.31	145.69	146.07	110
120	146.07	146.44	146.82	147.20	147.57	147.95	148.33	148.70	149.08	149.46	149.83	120
130	149.83	150.21	150.58	150.96	151.33	151.71	152.08	152.46	152.83	153.21	153.58	130
140	153.58	153.96	154.33	154.71	155.08	155.46	155.83	156.20	156.58	156.95	157.33	140
<b>150</b>	157.33	157.70	158.07	158.45	158.82	159.19	159.56	159.94	160.31	160.68	161.05	<b>150</b>
160	161.05	161.43	161.80	162.17	162.54	162.91	163.29	163.66	164.03	164.40	164.77	160
170	164.77	165.14	165.51	165.89	166.26	166.63	167.00	167.37	167.74	168.11	168.48	170
180	168.48	168.85	169.22	169.59	169.96	170.33	170.70	171.07	171.43	171.80	172.17	180
190	172.17	172.54	172.91	173.28	173.65	174.02	174.38	174.75	175.12	175.49	175.86	190
<b>200</b>	175.86	176.22	176.59	176.96	177.33	177.69	178.06	178.43	178.79	179.16	179.53	<b>200</b>
210	179.53	179.89	180.26	180.63	180.99	181.36	181.72	182.09	182.46	182.82	183.19	210
220	183.19	183.55	183.92	184.28	184.65	185.01	185.38	185.74	186.11	186.47	186.84	220
230	186.84	187.20	187.56	187.93	188.29	188.66	189.02	189.38	189.75	190.11	190.47	230
240	190.47	190.84	191.20	191.56	191.92	192.29	192.65	193.01	193.37	193.74	194.10	240
<b>250</b>	194.10	194.46	194.82	195.18	195.55	195.91	196.27	196.63	196.99	197.35	197.71	<b>250</b>
260	197.71	198.07	198.43	198.79	199.15	199.51	199.87	200.23	200.59	200.95	201.31	260
270	201.31	201.67	202.03	202.39	202.75	203.11	203.47	203.83	204.19	204.55	204.90	270
280	204.90	205.26	205.62	205.98	206.34	206.70	207.05	207.41	207.77	208.13	208.48	280
290	208.48	208.84	209.20	209.56	209.91	210.27	210.63	210.98	211.34	211.70	212.05	290
°C	0	1	2	3	4	5	6	7	8	9	10	°C

# Resistance Temperature Table

Platinum Resistance at 0° C – 100 ohms | Temperature Coefficient – .00385 ohms/ohm °C

°C	0	1	2	3	4	5	6	7	8	9	10	°C
<b>300</b>	212.05	212.41	212.76	213.12	213.48	213.83	214.19	214.54	214.90	215.25	215.61	<b>300</b>
310	215.61	215.96	216.32	216.67	217.03	217.38	217.74	218.09	218.44	218.80	219.15	310
320	219.15	219.51	219.86	220.21	220.57	220.92	221.27	221.63	221.98	222.33	222.68	320
330	222.68	223.04	223.39	223.74	224.09	224.45	224.80	225.15	225.50	225.85	226.21	330
340	226.21	226.56	226.91	227.26	227.61	227.96	228.31	228.66	229.02	229.37	229.72	340
<b>350</b>	229.72	230.07	230.42	230.77	231.12	231.47	231.82	232.17	232.52	232.87	233.21	<b>350</b>
360	233.21	233.56	233.91	234.26	234.61	234.96	235.31	235.66	236.00	236.35	236.70	360
370	236.70	237.05	237.40	237.74	238.09	238.44	238.79	239.13	239.48	239.83	240.18	370
380	240.18	240.52	240.87	241.22	241.56	241.91	242.26	242.60	242.95	243.29	243.64	380
390	243.64	243.99	244.33	244.68	245.02	245.37	245.71	246.06	246.40	246.75	247.09	390
<b>400</b>	247.09	247.44	247.78	248.13	248.47	248.81	249.16	249.50	249.85	250.19	250.53	<b>400</b>
410	250.53	250.88	251.22	251.56	251.91	252.25	252.59	252.93	253.28	253.62	253.96	410
420	253.96	254.30	254.65	254.99	255.33	255.67	256.01	256.35	256.70	257.04	257.38	420
430	257.38	257.72	258.06	258.40	258.74	259.08	259.42	259.76	260.10	260.44	260.78	430
440	260.78	261.12	261.46	261.80	262.14	262.48	262.82	263.16	263.50	263.84	264.18	440
<b>450</b>	264.18	264.52	264.86	265.20	265.53	265.87	266.21	266.55	266.89	267.22	267.56	<b>450</b>
460	267.56	267.90	268.24	268.57	268.91	269.25	269.59	269.92	270.26	270.60	270.93	460
470	270.93	271.27	271.61	271.94	272.28	272.61	272.95	273.29	273.62	273.96	274.29	470
480	274.29	274.63	274.96	275.30	275.63	275.97	276.30	276.64	276.97	277.31	277.64	480
490	277.64	277.98	278.31	278.64	278.98	279.31	279.64	279.98	280.31	280.64	280.98	490
<b>500</b>	280.98	281.31	281.64	281.98	282.31	282.64	282.97	283.31	283.64	283.97	284.30	<b>500</b>
510	284.30	284.63	284.97	285.30	285.63	285.96	286.29	286.62	286.95	287.29	287.62	510
520	287.62	287.95	288.28	288.61	288.94	289.27	289.60	289.93	290.26	290.59	290.92	520
530	290.92	291.25	291.58	291.91	292.24	292.56	292.89	293.22	293.55	293.88	294.21	530
540	294.21	294.54	294.86	295.19	295.52	295.85	296.18	296.50	296.83	297.16	297.49	540
<b>550</b>	297.49	297.81	298.14	298.47	298.80	299.12	299.45	299.78	300.10	300.43	300.75	<b>550</b>
560	300.75	301.08	301.41	301.73	302.06	302.38	302.71	303.03	303.36	303.69	304.01	560
570	304.01	304.34	304.66	304.98	305.31	305.63	305.96	306.28	306.61	306.93	307.25	570
580	307.25	307.58	307.90	308.23	308.55	308.87	309.20	309.52	309.84	310.16	310.49	580
590	310.49	310.81	311.13	311.45	311.78	312.10	312.42	312.74	313.06	313.39	313.71	590
<b>600</b>	313.71	314.03	314.35	314.67	314.99	315.31	315.64	315.96	316.28	316.60	316.92	<b>600</b>
610	316.92	317.24	317.56	317.88	318.20	318.52	318.84	319.16	319.48	319.80	320.12	610
620	320.12	320.43	320.75	321.07	321.39	321.71	322.03	322.35	322.67	322.98	323.30	620
630	323.30	323.62	323.94	324.26	324.57	324.89	325.21	325.53	325.84	326.16	326.48	630
640	326.48	326.79	327.11	327.43	327.74	328.06	328.38	328.69	329.01	329.32	329.64	640
<b>650</b>	329.64	329.96	330.27	330.59	330.90	331.22	331.53	331.85	332.16	332.48	332.79	<b>650</b>
660	332.79											660
°C	0	1	2	3	4	5	6	7	8	9	10	°C



# Resistance Temperature Table

Platinum Resistance at 0° C – 100 ohms

Temperature Coefficient – .003916 ohms/ohm °C

°C	0	1	2	3	4	5	6	7	8	9	10	°C
<b>-200</b>	17.14											<b>-200</b>
-190	21.46	21.03	20.59	20.16	19.73	19.29	18.86	18.43	18.00	17.57	17.14	-190
-180	25.80	25.37	24.93	24.50	24.07	23.63	23.20	22.76	22.33	21.90	21.46	-180
-170	30.12	29.69	29.26	28.83	28.40	27.97	27.53	27.10	26.67	26.24	25.80	-170
-160	34.42	33.99	33.56	33.13	32.70	32.28	31.85	31.42	30.99	30.56	30.12	-160
<b>-150</b>	38.68	38.26	37.83	37.41	36.98	36.55	36.13	35.70	35.27	34.85	34.42	<b>-150</b>
-140	42.91	42.49	42.07	41.64	41.22	40.80	40.38	39.95	39.53	39.10	38.68	-140
-130	47.11	46.69	46.27	45.85	45.43	45.01	44.59	44.17	43.75	43.33	42.91	-130
-120	51.29	50.87	50.45	50.04	49.62	49.20	48.78	48.37	47.95	47.53	47.11	-120
-110	55.44	55.02	54.61	54.19	53.78	53.36	52.95	52.53	52.12	51.70	51.29	-110
<b>-100</b>	59.57	59.16	58.74	58.33	57.92	57.50	57.09	56.68	56.26	55.85	55.44	<b>-100</b>
-90	63.68	63.27	62.86	62.45	62.04	61.63	61.21	60.80	60.39	59.98	59.57	-90
-80	67.77	67.36	66.96	66.55	66.14	65.73	65.32	64.91	64.50	64.09	63.68	-80
-70	71.85	71.44	71.04	70.63	70.22	69.81	69.41	69.00	68.59	68.18	67.77	-70
-60	75.91	75.51	75.10	74.70	74.29	73.88	73.48	73.07	72.66	72.26	71.85	-60
<b>-50</b>	79.96	79.56	79.15	78.75	78.34	77.94	77.53	77.13	76.72	76.32	75.91	<b>-50</b>
-40	83.99	83.59	83.19	82.79	82.38	81.98	81.58	81.17	80.77	80.36	79.96	-40
-30	88.01	87.61	87.21	86.81	86.41	86.01	85.60	85.20	84.80	84.40	83.99	-30
-20	92.01	91.62	91.22	90.82	90.42	90.02	89.62	89.22	88.82	88.42	88.01	-20
-10	96.02	95.62	95.22	94.82	94.42	94.02	93.62	93.22	92.82	92.42	92.02	-10
<b>-0</b>	100.00	99.60	99.20	98.81	98.41	98.01	97.61	97.21	96.81	96.42	96.02	<b>0</b>
<b>0</b>	100.00	100.40	100.80	101.19	101.59	101.99	102.38	102.78	103.18	103.57	103.97	<b>0</b>
10	103.97	104.37	104.76	105.16	105.56	105.95	106.35	106.74	107.14	107.53	107.93	10
20	107.93	108.32	108.72	109.11	109.51	109.90	110.30	110.69	111.09	111.48	111.88	20
30	111.88	112.27	112.66	113.06	113.45	113.84	114.24	114.63	115.02	115.42	115.81	30
40	115.81	116.20	116.59	116.99	117.38	117.77	118.16	118.56	118.95	119.34	119.73	40
<b>50</b>	119.73	120.12	120.51	120.91	121.30	121.69	122.08	122.47	122.86	123.25	123.64	<b>50</b>
60	123.64	124.03	124.42	124.81	125.20	125.59	125.98	126.37	126.76	127.15	127.54	60
70	127.54	127.93	128.32	128.71	129.09	129.48	129.87	130.26	130.65	131.04	131.42	70
80	131.42	131.81	132.20	132.59	132.98	133.36	133.75	134.14	134.52	134.91	135.30	80
90	135.30	135.68	136.07	136.46	136.84	137.23	137.62	138.00	138.39	138.77	139.16	90
<b>100</b>	139.16	139.55	139.93	140.32	104.70	141.09	141.47	141.86	142.24	142.63	143.01	<b>100</b>
110	143.01	143.39	143.78	144.16	144.55	144.93	145.31	145.70	146.08	146.46	146.85	110
120	146.85	147.23	147.61	148.00	148.38	148.76	149.15	149.53	149.91	150.29	150.67	120
130	150.67	151.06	151.44	151.82	152.20	152.58	152.96	153.35	153.73	154.11	154.49	130
140	154.49	154.87	155.25	155.63	156.01	156.39	156.77	157.15	157.53	157.91	158.29	140
<b>150</b>	158.29	158.67	159.05	159.43	159.81	160.19	160.57	160.95	161.33	161.70	162.08	<b>150</b>
160	162.08	162.46	162.84	163.22	163.60	163.97	164.35	164.73	165.11	165.48	165.86	160
170	165.86	166.24	166.62	166.99	167.37	167.75	168.12	168.50	168.88	169.25	169.63	170
180	169.63	170.00	170.38	170.76	171.13	171.51	171.88	172.26	172.63	173.01	173.38	180
190	173.38	173.76	174.13	174.51	174.88	175.26	175.63	176.01	176.38	176.75	177.13	190
<b>200</b>	177.13	177.50	177.88	178.25	178.62	179.00	179.37	179.74	180.12	180.49	180.86	<b>200</b>
210	180.86	181.23	181.61	181.98	182.35	182.72	183.09	183.47	183.84	184.21	184.58	210
220	184.58	184.95	185.32	185.70	186.07	186.44	186.81	187.18	187.55	187.92	188.29	220
230	188.29	188.66	189.03	189.40	189.77	190.14	190.51	190.88	191.25	191.62	191.99	230
240	191.99	192.36	192.73	193.09	193.46	193.83	194.20	194.57	194.94	195.31	195.67	240
°C	0	1	2	3	4	5	6	7	8	9	10	°C

# Resistance Temperature Table

Platinum Resistance at 0° C – 100 ohms

Temperature Coefficient – .003916 ohms/ohm °C

°C	0	1	2	3	4	5	6	7	8	9	10	°C
<b>250</b>	195.67	196.04	196.41	196.78	197.14	197.51	197.88	198.25	198.61	198.98	199.35	<b>250</b>
260	199.35	199.71	200.08	200.45	200.81	201.18	201.55	201.91	202.28	202.64	203.01	260
270	203.01	203.38	203.74	204.11	204.47	204.84	205.20	205.57	205.93	206.30	206.66	270
280	206.66	207.02	207.39	207.75	208.12	208.48	208.85	209.21	209.57	209.94	210.30	280
290	210.30	210.66	211.03	211.39	211.75	212.11	212.48	212.84	213.20	213.56	213.93	290
<b>300</b>	213.93	214.29	214.65	215.01	215.37	215.74	216.10	216.46	216.82	217.18	217.54	<b>300</b>
310	217.54	217.90	218.26	218.63	218.99	219.35	219.71	220.07	220.43	220.79	221.15	310
320	221.15	221.51	221.87	222.23	222.59	222.94	223.30	223.66	224.02	224.38	224.74	320
330	224.74	225.10	225.46	225.81	226.17	226.53	226.89	227.25	227.61	227.96	228.32	330
340	228.32	228.68	229.04	229.39	229.75	230.11	230.46	230.82	231.18	231.53	231.89	340
350	231.89	232.25	232.60	232.96	233.31	233.67	234.03	234.38	234.74	235.09	235.45	<b>350</b>
360	235.45	235.80	236.16	236.51	236.87	237.22	237.58	237.93	238.28	238.64	238.99	360
370	238.99	239.35	239.70	240.05	240.41	240.76	241.11	241.47	241.82	242.17	242.53	370
380	242.53	242.88	243.23	243.58	243.94	244.29	244.64	244.99	245.35	245.70	246.05	380
390	246.05	246.40	246.75	247.10	247.46	247.81	248.16	248.51	248.86	249.21	249.56	390
<b>400</b>	249.56	249.91	250.26	250.61	250.96	251.31	251.66	252.01	252.36	252.71	253.06	<b>400</b>
410	253.06	253.41	253.76	254.11	254.46	254.80	255.15	255.50	255.85	256.20	256.55	410
420	256.55	256.89	257.24	257.59	257.94	258.29	258.63	258.98	259.33	259.67	260.02	420
430	260.02	260.37	260.72	261.06	261.41	261.75	262.10	262.45	262.79	263.14	263.49	430
440	263.49	263.83	264.18	264.52	264.87	265.21	265.56	265.90	266.25	266.59	266.94	440
<b>450</b>	266.94	267.28	267.63	267.97	268.31	268.66	269.00	269.35	269.69	270.03	270.38	<b>450</b>
460	270.38	270.72	271.06	271.41	271.75	272.09	272.44	272.78	273.12	273.46	273.80	460
470	273.80	274.15	274.49	274.83	275.17	275.51	275.86	276.20	276.54	276.88	277.22	470
480	277.22	277.56	277.90	278.24	278.58	278.92	279.26	279.61	279.95	280.29	280.63	480
490	280.63	280.96	281.30	281.64	281.98	282.32	282.66	283.00	283.34	283.68	284.02	490
<b>500</b>	284.02	284.36	284.69	285.03	285.37	285.71	286.05	286.39	286.72	287.06	287.40	<b>500</b>
510	287.40	287.74	288.07	288.41	288.75	289.08	289.42	289.76	290.09	290.43	290.77	510
520	290.77	291.10	291.44	291.77	292.11	292.45	292.78	293.12	293.45	293.79	294.12	520
530	294.12	294.46	294.79	295.13	295.46	295.80	296.13	296.46	296.80	297.13	297.47	530
540	297.47	297.80	298.13	298.47	298.80	299.13	299.47	299.80	300.13	300.47	300.80	540
<b>550</b>	300.80	301.13	301.46	301.80	302.13	302.46	302.79	303.12	303.46	303.79	304.12	<b>550</b>
560	304.12	304.45	304.78	305.11	305.44	305.77	306.11	306.44	306.77	307.10	307.43	560
570	307.43	307.76	308.09	308.42	308.75	309.08	309.41	309.74	310.06	310.39	310.72	570
580	310.72	311.05	311.38	311.71	312.04	312.37	312.69	313.02	313.35	313.68	314.01	580
590	314.01	314.33	314.66	314.99	315.32	315.64	315.97	316.30	316.62	316.95	317.28	590
<b>600</b>	317.28	317.60	317.93	318.26	318.58	318.91	319.23	319.56	319.89	320.21	320.54	<b>600</b>
610	320.54	320.86	321.19	321.51	321.84	322.16	322.49	322.81	323.13	323.46	323.78	610
620	323.78	324.11	324.43	324.75	325.08	325.40	325.72	326.05	326.37	326.69		620
°C	0	1	2	3	4	5	6	7	8	9	10	°C

# Resistance Temperature Table

Platinum Resistance at 0° C – 100 ohms

Temperature Coefficient – .00392 ohms/ohm °C

°C	0	1	2	3	4	5	6	7	8	9	10	°C
<b>-200</b>	17.08											<b>-200</b>
-190	21.46	21.02	20.58	20.15	19.71	19.27	18.83	18.40	17.96	17.52	17.08	-190
-180	25.80	25.37	24.94	24.50	24.07	23.63	23.20	22.76	22.33	21.89	21.46	-180
-170	30.11	29.68	29.25	28.82	28.39	27.96	27.53	27.10	26.67	26.23	25.80	-170
-160	34.39	33.97	33.54	33.11	32.69	32.26	31.83	31.40	30.97	30.54	30.11	-160
<b>-150</b>	38.65	38.22	37.80	37.37	36.95	36.52	36.10	35.67	35.25	34.82	34.39	<b>-150</b>
-140	42.87	42.45	42.03	41.61	41.19	40.76	40.34	39.92	39.49	39.07	38.65	-140
-130	47.07	46.66	46.24	45.82	45.40	44.98	44.56	44.14	43.72	43.29	42.87	-130
-120	51.25	50.84	50.42	50.00	49.58	49.17	48.75	48.33	47.91	47.49	47.07	-120
-110	55.41	54.99	54.58	54.16	53.75	53.33	52.92	52.50	52.09	51.67	51.25	-110
<b>-100</b>	59.54	59.13	58.72	58.30	57.89	57.48	57.06	56.65	56.24	55.82	55.41	<b>-100</b>
-90	63.66	63.25	62.84	62.43	62.01	61.60	61.19	60.78	60.37	59.96	59.54	-90
-80	67.76	67.35	66.94	66.53	66.12	65.71	65.30	64.89	64.48	64.07	63.66	-80
-70	71.84	71.43	71.02	70.61	70.21	69.80	69.39	68.98	68.57	68.17	67.76	-70
-60	75.90	75.50	75.09	74.68	74.28	73.87	73.47	73.06	72.65	72.24	71.84	-60
<b>-50</b>	79.95	79.55	79.14	78.74	78.33	77.93	77.52	77.12	76.71	76.31	75.90	<b>-50</b>
-40	83.99	83.58	83.18	82.78	82.38	81.97	81.57	81.16	80.76	80.36	79.95	-40
-30	88.01	87.61	87.21	86.80	86.40	86.00	85.60	85.20	84.79	84.39	83.99	-30
-20	92.02	91.62	91.22	90.82	90.42	90.02	89.61	89.21	88.81	88.41	88.01	-20
-10	96.02	95.62	95.22	94.82	94.42	94.02	93.62	93.22	92.82	92.42	92.02	-10
<b>0</b>	100.00	99.60	99.20	98.81	98.41	98.01	97.61	97.21	96.81	96.41	96.02	<b>0</b>
<b>0</b>	100.00	100.40	100.80	101.19	101.59	101.99	102.39	102.78	103.18	103.58	103.97	<b>0</b>
10	103.97	104.37	104.77	105.16	105.56	105.95	106.35	106.75	107.14	107.54	107.93	10
20	107.93	108.33	108.72	109.12	109.52	109.91	110.30	110.70	111.09	111.49	111.88	20
30	111.88	112.28	112.67	113.07	113.46	113.85	114.25	114.64	115.03	115.43	115.82	30
40	115.82	116.21	116.61	117.00	117.39	117.79	118.18	118.57	118.96	119.35	119.75	40
<b>50</b>	119.75	120.14	120.53	120.92	121.31	121.71	122.10	122.49	122.88	123.27	123.66	<b>50</b>
60	123.66	124.05	124.44	124.83	125.22	125.61	126.00	126.39	126.78	127.17	127.56	60
70	127.56	127.95	128.34	128.73	129.12	129.51	129.90	130.29	130.68	131.07	131.45	70
80	131.45	131.84	132.23	132.62	133.01	133.39	133.78	134.17	134.56	134.95	135.33	80
90	135.33	135.72	136.11	136.49	136.88	137.27	137.65	138.04	138.43	138.81	139.20	90
<b>100</b>	139.20	139.59	139.97	140.36	140.74	141.13	141.51	141.90	142.29	142.67	143.06	<b>100</b>
110	143.06	143.44	143.83	144.21	144.59	144.98	145.36	145.75	146.13	146.52	146.90	110
120	146.90	147.28	147.67	148.05	148.43	148.82	149.20	149.58	149.97	150.35	150.73	120
130	150.73	151.11	151.50	151.88	152.26	152.64	153.02	153.41	153.79	154.17	154.55	130
140	154.55	154.93	155.31	155.70	156.08	156.46	156.84	157.22	157.60	157.98	158.36	140
<b>150</b>	158.36	158.74	159.12	159.50	159.88	160.26	160.64	161.02	161.40	161.78	162.16	<b>150</b>
160	162.16	162.54	162.91	163.29	163.67	164.05	164.43	164.81	165.19	165.56	165.94	160
170	165.94	166.32	166.70	167.07	167.45	167.83	168.21	168.58	168.96	169.34	169.71	170
180	169.71	170.09	170.47	170.84	171.22	171.60	171.97	172.35	172.73	173.10	173.48	180
190	173.48	173.85	174.23	174.60	174.98	175.35	175.73	176.10	176.48	176.85	177.23	190
<b>200</b>	177.23	177.60	177.97	178.35	178.72	179.10	179.47	179.84	180.22	180.59	180.96	<b>200</b>
210	180.96	181.34	181.71	182.08	182.46	182.83	183.20	183.57	183.95	184.32	184.69	210
220	184.69	185.06	185.43	185.81	186.18	186.55	186.92	187.29	187.66	188.03	188.41	220
230	188.41	188.78	189.15	189.52	189.89	190.26	190.63	191.00	191.37	191.74	192.11	230
240	192.11	192.48	192.85	193.22	193.59	193.96	194.32	194.69	195.06	195.43	195.80	240
<b>250</b>	195.80	196.17	196.54	196.90	197.27	197.64	198.01	198.38	198.74	199.11	199.48	<b>250</b>
260	199.48	199.85	200.21	200.58	200.95	201.31	201.68	202.05	202.41	202.78	203.15	260
270	203.15	203.51	203.88	204.24	204.61	204.98	205.34	205.71	206.07	206.44	206.80	270
280	206.80	207.17	207.53	207.90	208.26	208.63	208.99	209.35	209.72	210.08	210.45	280
290	210.45	210.81	211.17	211.54	211.90	212.26	212.63	212.99	213.35	213.72	214.08	290
<b>°C</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>°C</b>

# Resistance Temperature Table

Platinum Resistance at 0° C – 100 ohms

Temperature Coefficient – .00392 ohms/ohm °C

°C	0	1	2	3	4	5	6	7	8	9	10	°C
<b>300</b>	214.08	214.44	214.80	215.17	215.53	215.89	216.25	216.61	216.98	217.34	217.70	<b>300</b>
310	217.70	218.06	218.42	218.78	219.14	219.51	219.87	220.23	220.59	220.95	221.31	310
320	221.31	221.67	222.03	222.39	222.75	223.11	223.47	223.83	224.19	224.55	224.91	320
330	224.91	225.26	225.62	225.98	226.34	226.70	227.06	227.42	227.78	228.13	228.49	330
340	228.49	228.85	229.21	229.56	229.92	230.28	230.64	230.99	231.35	231.71	232.07	340
<b>350</b>	232.07	232.42	232.78	233.13	233.49	233.85	234.20	234.56	234.92	235.27	235.63	<b>350</b>
360	235.63	235.98	236.34	236.69	237.05	237.40	237.76	238.11	238.47	238.82	239.18	360
370	239.18	239.53	239.89	240.24	240.59	240.95	241.30	241.66	242.01	242.36	242.72	370
380	242.72	243.07	243.42	243.78	244.13	244.48	244.83	245.19	245.54	245.89	246.24	380
390	246.24	246.59	246.95	247.30	247.65	248.00	248.35	248.70	249.06	249.41	249.76	390
<b>400</b>	249.76	250.11	250.46	250.81	251.16	251.51	251.86	252.21	252.56	252.91	253.26	<b>400</b>
410	253.26	253.61	253.96	254.31	254.66	255.01	255.36	255.71	256.06	256.40	256.75	410
420	256.75	257.10	257.45	257.80	258.15	258.49	258.84	259.19	259.54	259.89	260.23	420
430	260.23	260.58	260.93	261.27	261.62	261.97	262.31	262.66	263.01	263.35	263.70	430
440	263.70	264.05	264.39	264.74	265.08	265.43	265.78	266.12	266.47	266.81	267.16	440
<b>450</b>	267.16	267.50	267.85	268.19	268.54	268.88	269.23	269.57	269.91	270.26	270.60	<b>450</b>
460	270.60	270.95	271.29	271.63	271.98	272.32	272.66	273.01	273.35	273.69	274.03	460
470	274.03	274.38	274.72	275.06	275.40	275.75	276.09	276.43	276.77	277.11	277.46	470
480	277.46	277.80	278.14	278.48	278.82	279.16	279.50	279.84	280.18	280.52	280.87	480
490	280.87	281.21	281.55	281.89	282.23	282.57	282.91	283.24	283.58	283.92	284.26	490
<b>500</b>	284.26	284.60	284.94	285.28	285.62	285.96	286.30	286.63	286.97	287.31	287.65	<b>500</b>
510	287.65	287.99	288.32	288.66	289.00	289.34	289.67	290.01	290.35	290.69	291.02	510
520	291.02	291.36	291.70	292.03	292.37	292.71	293.04	293.38	293.71	294.05	294.39	520
530	294.39	294.72	295.06	295.39	295.73	296.06	296.40	296.73	297.07	297.40	297.74	530
540	297.74	298.07	298.41	298.74	299.07	299.41	299.74	300.07	300.41	300.74	301.08	540
<b>550</b>	301.08	301.41	301.74	302.07	302.41	302.74	303.07	303.41	303.74	304.07	304.40	<b>550</b>
560	304.40	304.73	305.07	305.40	305.73	306.06	306.39	306.72	307.06	307.39	307.72	560
570	307.72	308.05	308.38	308.71	309.04	309.37	309.70	310.03	310.36	310.69	311.02	570
580	311.02	311.35	311.68	312.01	312.34	312.67	313.00	313.33	313.66	313.99	314.31	580
590	314.31	314.64	314.97	315.30	315.63	315.96	316.28	316.61	316.94	317.27	317.59	590
<b>600</b>	317.59	317.92	318.25	318.58	318.90	319.23	319.56	319.88	320.21	320.54	320.86	<b>600</b>
610	320.86	321.19	321.52	321.84	322.17	322.49	322.82	323.14	323.47	323.79	324.12	610
620	324.12	324.44	324.77	325.09	325.42	325.74	326.07	326.39	326.72	327.04	327.36	620
630	327.36	327.69	328.01	328.34	328.66	328.98	329.31	329.63	329.95	330.28	330.60	630
640	330.60	330.92	331.24	331.57	331.89	332.21	332.53	332.85	333.18	333.50	333.82	640
<b>650</b>	333.82	334.14	334.46	334.78	335.11	335.43	335.75	336.07	336.39	336.71	337.03	<b>650</b>
660	337.03											660
°C	0	1	2	3	4	5	6	7	8	9	10	°C

# Chemical Resistance Chart

	Carbon Steel	Alloy 600	Monel	Nickel	304 SS	316 SS		Carbon Steel	Alloy 600	Monel	Nickel	304 SS	316 SS	
Acetate Solvents, Crude	D	A	B	B	A	A	Chromic Acid, <10%, Boiling	D	C	C	D	C	B	
Acetate Solvents, Pure	C	A	A	A	A	A	Chromic Acid, >10%, Boiling	D	C	D	D	D	C	
Acetaldehyde, 100%	X	B	A	B	A	A	Citric Acid, Dilute	D	A	A	B	A	A	
Acetic Acid, 95%	D	A	A	A	B	A	Citric Acid, Hot, Concentrate	D	B	B	B	C	B	
Acetic Acid Vapors, 100% Hot	B	B	B	B	D	B	Copper Nitrate, Hot, Concentrate	D	C	D	D	A	A	
Acetic Anhydride, Boiling	D	A	A	B	B	A	Copper Sulfate, Hot, Concentrate	D	B	C	C	B	A	
Acetone	B	A	A	A	A	A	Creosote, Hot	B	A	A	A	A	A	
Alcohols	B	A	A	A	A	A	Cupric Chloride, <2%	D	C	B	B	B	B	
Alum Potassium, 10%	D	B	B	B	B	A	Cupric Chloride, 5%	D	D	D	C	D	C	
Aluminum Chloride, 10%	D	B	B	B	D	C	Dichloroethane, Boiling	D	B	A	A	B	B	
Aluminum Chloride, 10%, Boiling	D	C	C	B	D	D	Ethyl Chloride	A	A	A	A	A	A	
Aluminum Sulfate, 10%	D	A	A	A	C	B	Ethylene Glycol	A	A	A	A	A	A	
Aluminum Sulfate, <10%, Boiling	D	B	B	B	D	B	Fatty Acids, 145°F	C	A	A	A	B	A	
Aluminum Sulfate, >10%, Boiling	D	B	B	B	D	B	Ferric Chloride, >1%	D	D	D	D	D	D	
Amines	B	A	A	A	A	A	Ferric Chloride, <1%	D	D	D	D	D	D	
Ammonia, Anhydrous	B	A	A	A	A	A	Ferric Chloride, <1%, Boiling	D	D	D	D	D	D	
Ammonium Chloride, 10%	C	A	A	A	B	A	Ferric Chloride, >1%, Boiling	D	D	D	D	D	D	
Ammonium Chloride, <10%, Boiling	D	B	B	B	D	C	Ferric Nitrate, 5%	D	C	D	D	B	A	
Ammonium Chloride, >10%, Boiling	D	C	B	B	D	C	Ferric Sulfate, 5%	D	B	C	C	B	A	
Ammonium Hydroxide, Hot	B	A	D	D	A	A	Ferrous Sulfate, 10%	C	B	A	A	A	A	
Ammonium Nitrate	B	A	C	C	A	A	Fluorine, Dry Gas	C	A	A	A	C	B	
Ammonium Persulfate 5%	D	A	D	D	A	A	Fluorine, Dry 300°F	D	B	A	A	D	C	
Ammonium Phosphate, Didasic, 5%	D	A	B	C	A	A	Fluorine, Moist Gas	D	B	A	B	D	D	
Ammonium Sulfate, >10%	D	B	B	B	C	B	Formaldehyde, 40%	C	A	A	A	B	A	
Ammonium Sulfite, >10%, Boiling	D	B	B	B	B	C	Formic Acid, <50%	D	A	B	B	B	A	
Ammonium Sulfite, Boiling	D	D	C	D	C	B	Formic Acid, >50%	D	B	B	B	B	A	
Aniline Hydrochloride	D	B	B	B	D	C	Formic Acid, <50%, Hot	D	B	B	B	B	A	
Antimony Trichloride	D	B	B	B	D	C	Formic Acid, >50%, Hot	D	B	B	B	C	B	
Asphalt	B	A	A	B	A	A	Freon, Wet	C	B	A	A	C	C	
Barium Chloride, 5%	C	A	A	A	A	A	Fuel Oil, 14°F	A	A	B	B	A	A	
Barium Chloride, >5%, Hot	D	B	A	A	C	B	Furfural	B	B	B	B	B	B	
Barium Hydroxide	C	A	A	A	A	A	Gasoline, Refined	A	A	A	A	A	A	
Barium Nitrate	C	B	C	C	A	A	Glycerine	A	A	A	A	A	A	
Beer, 160°F	C	A	A	A	A	A	Hydrochloric Acid, <1%	D	B	B	B	D	B	
Beet Sugar Liquor, Hot	B	A	A	A	A	A	Hydrochloric Acid, 1.20%	D	C	B	B	D	D	
Benzene, Hot	B	A	A	A	A	A	Hydrochloric Acid, >20%	D	D	D	C	D	D	
Benzoic Acid	B	A	A	A	A	A	Hydrochloric Acid, <1/2%, 175°F	D	C	B	B	D	D	
Blood	D	A	A	A	A	A	Hydrochloric Acid, 1/2-2%, 175°F	D	D	C	C	D	D	
Borax, Hot	B	A	A	B	A	A	Hydrochloric Acid, >2%, 175°F	D	D	D	D	D	D	
Boric Acid, 5% Hot	D	A	B	B	B	B	Hydrochloric Acid, 1/4%, Boiling	D	C	B	B	D	D	
Bromine, Dry Gas	D	B	A	A	D	D	Hydrochloric Acid, 1/4-1%, Boiling	D	C	C	C	D	D	
Bromine, Moist Gas	D	D	C	C	D	D	Hydrochloric Acid, 1%, Boiling	D	D	D	D	D	D	
Buttermilk	D	A	A	A	A	A	Hydrofluoric Acid, <40%	C	C	B	B	D	D	
Butyric Acid, Dilute	X	A	A	A	A	A	Hydrofluoric Acid, >40%	C	C	B	C	D	D	
Butyric Acid, Hot, Concentrate	D	B	B	C	C	B	Hydrofluoric Acid, Boiling	D	D	B	C	D	D	
Calcium Bisulfite, Hot	D	D	D	D	C	B	Hydrofluosilicic Acid	D	B	A	A	B	D	C
Calcium Chloride, Dilute	C	A	A	A	B	A	Hydrogen Chloride, Dry	B	A	A	A	D	C	
Calcium Hydroxide, 10% Boiling	D	A	A	A	A	A	Hydrogen Chloride, Moist	D	D	C	C	D	D	
Calcium Hydroxide, 20% Boiling	D	A	A	A	A	A	Hydrogen Fluoride, Dry	C	A	A	A	D	C	
Calcium Hydroxide, 30% Boiling	D	A	A	A	C	B	Hydrogen Peroxide, Boiling	D	B	B	B	C	B	
Calcium Hypochloride, <2%	C	B	C	C	C	B	Hydrogen Sulfide, Dry	B	A	A	A	A	A	
Carbolic Acid, 90%	C	A	B	A	A	A	Hydrogen Sulfide, Moist	C	A	B	B	B	A	
Carbon Dioxide, Dry	B	A	A	A	A	A	Iodine, Dry	D	A	A	A	D	B	
Carbon Disulfide	B	A	B	B	A	A	Kerosene	A	A	A	A	A	A	
Carbon Tetrachloride, Dry, Hot	C	A	A	A	B	A	Lactic Acid, 5%	D	A	B	B	B	A	
Carbonic Acid, Saturated	D	A	A	A	A	A	Lactic Acid, 10%	D	A	B	B	B	A	
Chloracetic	D	B	B	B	D	C	Lactic Acid, 5%, Boiling	D	B	C	C	C	B	
Chloric Acid	D	C	C	C	D	C	Lactic Acid, 10%, Boiling	D	B	C	C	D	B	
Chlorinated Water, Saturated	D	C	C	C	D	C	Lead Acetate, Hot	D	B	B	C	A	A	
Chlorine, Dry Gas	B	A	A	A	B	B	Magnesium Chloride, 5%, Hot	D	A	A	A	C	B	
Chlorine, Moist Gas	D	D	C	C	D	C	Magnesium Hydroxide	B	A	A	A	A	A	
Chlorosulfonis Acid, Dilute	D	B	B	A	D	B	Magnesium Sulfate	B	B	A	B	A	A	
Chromic Acid, Dilute	B	B	B	B	B	A	Magnesium Sulfate, Boiling	C	C	A	B	A	A	

\*The information contained herein acts as a guide and Smart Sensors Inc., its' distributors and representatives specifically deny warranty expressed or implied.

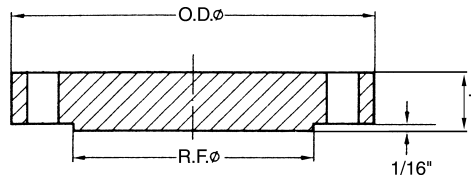
# Chemical Resistance Chart

	Carbon Steel	Alloy 600	Monel	Nickel	304 SS	316 SS		Carbon Steel	Alloy 600	Monel	Nickel	304 SS	316 SS
Mercury	B	A	B'	A	A	A	Sodium Hydroxide, <40%, 175°F	D	A	A	A	A	A
Mercuric Chloride, <2%	D	D	D	D	D	D	Sodium Hydroxide, 40-80%, 175°F	D	A	A	A	A	A
Mercuric Chloride, <1/2%, Boiling	D	D	D	D	D	D	Sodium Hydroxide, <30%, Boiling	D	A	B	A	A	A
Mercuric Cyanide	D	B	D	B	B	B	Sodium Hydroxide, >30%, Boiling	D	A	B	A	C	B
Methyl Chloride, Dry	D	A	A	A	B	B	Sodium Hydroxide, Molten	D	B	B	A	D	D
Milk	D	A	B	B	A	A	Sodium Hypochlorite (Still), 5%	D	C	C	C	C	B
Molasses	B	A	A	A	A	A	Sodium Hyposulfite	D	B	A	A	B	A
Naptha	B	A	A	A	A	A	Sodium Nitrate	B	A	B	A	B	A
Nickel Chloride	D	B	B	B	C	B	Sodium Perborate	C	A	B	B	A	A
Nickel Sulfate, Boiling	D	B	B	A	C	C	Sodium Peroxide	C	A	B	B	A	A
Nitric Acid, 20%	D	B	D	D	A	A	Sodium Phosphate, Tribasic	C	A	A	A	A	A
Nitric Acid, Fuming	D	B	D	D	B	B	Sodium Silicate	B	A	B	B	A	A
Nitric Acid, 20%, Boiling	D	C	D	D	A	A	Sodium Sulfate (All Concentrate)	B	B	A	A	B	A
Nitric Acid, 65%, Boiling	D	D	D	D	B	B	Sodium Sulfate, Hot	D	B	A	B	C	B
Nitric Acid, Boiling, Concentrate	D	D	D	D	D	D	Sodium Sulfide, Saturated	B	A	B	A	B	A
Nitrous Acid	D	B	C	C	B	B	Sodium Sulfite, Hot	D	C	B	C	B	A
Oxalic Acid, <10%	C	A	A	A	A	A	Sodium Thiosulfate	D	B	B	B	B	A
Oxalic Acid, 10%	C	A	A	A	A	A	Stannic Chloride, <5%	D	D	B	B	D	D
Oxalic Acid, 10%, Boiling	D	A	A	B	D	C	Stannic Chloride, >5%	D	D	C	D	D	D
Oxalic Acid, 50%, Boiling	D	B	B	C	D	C	Stannic Chloride, SG 1.21, Boiling	D	D	D	D	D	D
Phosphoric Acid (Ortho), <10%	D	A	B	B	B	A	Stannous Chloride, Saturated	D	B	B	B	D	B
Phosphoric Acid (Ortho), 10-50%	D	A	B	C	C	A	Steam, 212°F	A	A	A	A	A	A
Phosphoric Acid (Ortho), >50%	D	A	B	C	C	A	Steam, 600°F	C	A	A	A	A	A
Phosphoric Acid (Ortho), <20%, 175°F	D	C	B	D	D	A	Sulfite Liquors	D	D	D	D	C	B
Phosphoric Acid (Ortho), >20%, 175°F	D	D	B	D	D	B	Sulfur, Molten, 266°F	B	A	A	A	B	A
Phosphoric Acid (Ortho), <10%, Boiling	D	D	C	D	D	B	Sulfur Chloride	D	B	B	B	D	C
Phosphoric Acid (Ortho), 85%, Boiling	D	D	D	D	D	C	Sulfur Dioxide, 250°F, Dry	B	B	B	B	A	A
Picric Acid	C	D	D	D	A	A	Sulfur Dioxide, Moist	D	D	D	D	B	A
Potassium Bromide	D	A	A	A	C	B	Sulfuric Acid, <2%	D	B	B	B	C	B
Potassium Carbonate	B	A	A	A	A	A	Sulfuric Acid, 2-40%	D	B	B	B	D	D
Potassium Chlorate	B	A	B	B	A	A	Sulfuric Acid, 40%	D	B	B	B	D	D
Potassium Chloride	D	A	A	B	A	A	Sulfuric Acid, Concentrate	B	B	D	D	B	B
Potassium Chloride, Hot	D	B	A	B	C	B	Sulfuric Acid, <10%, Boiling	D	C	B	D	D	D
Potassium Cyanide	B	B	B	B	B	B	Sulfuric Acid, 10-80%, Boiling	D	D	C	D	D	D
Potassium Dichromate, Concentrate	C	B	B	C	A	A	Sulfuric Acid, Concentrate, Boiling	D	D	D	D	D	D
Potassium Ferricyanide, 5%	C	B	B	B	A	A	Sulfuric Acid, Saturated	D	D	D	D	B	B
Potassium Ferrocyanide, 5%	C	X	B	B	A	A	Tannic Acid, 10%	D	B	A	A	A	A
Potassium Hydroxide, 50%	B	A	A	A	A	A	Tar, Hot	B	A	B	B	A	A
Potassium Hydroxide, 30%, 175°F	D	A	A	A	A	A	Tartaric Acid, 120°F	D	A	A	A	B	A
Potassium Hydroxide, 50%, 175°F	D	A	A	A	B	A	Toluene	A	A	A	A	A	A
Potassium Hydroxide, 30%, Boiling	D	A	A	A	B	A	Trichlorethylene	B	A	A	A	A	A
Potassium Hydroxide, 50%, Boiling	D	A	A	A	B	A	Turpentine	B	A	A	A	A	A
Potassium Hypochlorite, Dilute	D	X	D	C	C	B	Varnish, Hot	C	A	A	A	A	A
Potassium Permanganate, Dilute	B	B	A	A	A	A	Vegetable Oils	B	A	B	B	A	A
Potassium Sulfate, Dilute	B	A	A	A	A	A	Vinegar	D	A	A	A	A	A
Potassium Sulfate, Dilute, Boiling	D	B	B	B	B	B	Water, Acid Mine	D	A	C	C	A	A
Potassium Sulfate, Saturated	C	A	C	A	A	A	Water, Boiler Feed	B	A	A	A	A	A
Propane, Liquid & Gas	B	A	A	A	A	A	Water, Distilled	D	A	A	A	A	A
Pyrogalllic Acid	B	B	A	A	A	A	Water, Salt Sea	D	B	A	C	C	B
Salicylic Acid	D	B	B	B	B	B	Whiskey, Boiling	D	A	C	B	A	A
Silver Bromide	D	C	B	C	B	A	Wine	D	A	C	B	A	A
Silver Chloride	D	C	B	C	D	D	Xylene, Boiling	X	A	A	B	A	A
Silver Nitrate	X	A	C	D	A	A	Zinc Chloride, 5%	D	B	B	B	C	B
Sodium Acetate	C	A	A	A	A	A	Zinc Chloride, 5%, Boiling	D	D	B	C	D	D
Sodium Bisulfate	D	B	A	B	B	B	Zinc Sulfate, Boiling	D	B	A	B	A	A
Sodium Bisulfate, 140°F	D	C	B	C	B	B							
Sodium Bromide, Dilute	X	B	A	B	B	A							
Sodium Carbonate, 5%, Hot	B	A	A	A	A	A							
Sodium Chloride, Dilute	C	A	A	A	A	A							
Sodium Chloride, Saturated, Boiling	D	A	A	A	C	B							
Sodium Cyanide	B	B	A	B	B	B							
Sodium Fluoride, 5%	D	B	A	A	B	A							
Sodium Hydroxide, 50%	B	A	A	A	A	A							

## GUIDE TO SELECTION

- A** Substantial Resistance — Preferred materials of construction.
- B** Moderate Resistance — Satisfactory. For use under most conditions; very slight swelling for elastomers.
- C** Questionable Resistance — Use with caution.
- D** Inadequate Resistance — Not recommended.
- X** No information available.

# Standard Pipe Flanges



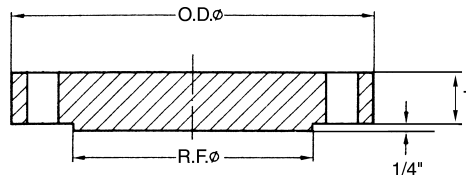
**Note:** "T" includes the 1/16" raised face thickness.

## Blind Flange

150 lb/sq. in.		ANSI (ASA) b 16.5		
Pipe		Flange		Raised Face R.F.
Nominal Size NW	O.D. in. mm	O.D. in. mm	T in. mm	in. mm
1/2"	0.84 21,3	3 - 1/2 88,9	7/16 11,1	1 - 3/8 34,9
3/4"	1.05 26,7	3 - 7/8 98,4	1/2 12,7	1 - 11/16 42,9
1"	1.315 33,4	4 - 1/4 107,9	9/16 14,3	2 50,8
1 - 1/4"	1.66 42,2	4 - 5/8 117,5	5/8 15,9	2 - 1/2 63,5
1 - 1/2"	1.90 48,3	5 127	11/16 17,5	2 - 7/8 73,0
2"	2.375 60,3	6 152,4	3/4 19,0	3 - 5/8 92,1
2 - 1/2"	2.875 73,0	7 177,8	7/8 22,2	4 - 1/8 104,8
3"	3.5 88,9	7 - 1/2 190,5	15/16 23,8	5 127
3 - 1/2"	4.00 101,6	8 - 1/2 215,9	15/16 23,8	5 - 1/2 139,7
4"	4.50 114,3	9 228,6	15/16 23,8	6 - 3/16 157,2
5"	5.563 141,3	10 254	15/16 23,8	7 - 5/16 185,7
6"	6.625 168,3	11 279,4	1 25,4	8 - 1/2 215,9
8"	8.625 219,1	13 - 1/2 342,9	1 - 1/8 28,6	10 - 5/8 269,9
10"	10.75 273	16 406,4	1 - 3/16 30,2	12 - 3/4 323,8
12"	12.75 323,8	19 482,6	1 - 1/4 31,7	15 381
14"	14.0 355,6	21 533,4	1 - 3/8 34,9	16 - 1/4 412,7
16"	16.0 406,4	23 - 1/2 596,9	1 - 7/16 36,5	18 - 1/2 469,9
18"	18.0 457,2	25 635	1 - 9/16 39,7	21 533,4
20"	20.0 508	27 - 1/2 698,5	1 - 11/16 42,9	23 584,2
24"	24.0 609,6	32 812,8	1 - 7/8 47,6	27 - 1/4 692,1

300 lb/sq. in.		ANSI (ASA) b 16.5		
Pipe		Flange		Raised Face R.F.
Nominal Size NW	O.D. in. mm	O.D. in. mm	T in. mm	in. mm
1/2"	0.84 21,3	3 - 3/4 95,2	9/16 14,3	1 - 3/8 34,9
3/4"	1.05 26,7	4 - 5/8 117,5	5/8 15,9	1 - 11/16 42,9
1"	1.315 33,4	4 - 7/8 123,8	11/16 17,5	2 50,8
1 - 1/4"	1.66 42,2	5 - 1/4 133,3	3/4 19,0	2 - 1/2 63,5
1 - 1/2"	1.90 48,3	6 - 1/8 155,6	13/16 20,6	2 - 7/8 73,0
2"	2.375 60,3	6 - 1/2 165,1	7/8 22,2	3 - 5/8 92,1
2 - 1/2"	2.875 73,0	7 - 1/2 190,5	1 25,4	4 - 1/8 104,8
3"	3.5 88,9	8 - 1/4 209,5	1 - 1/8 28,6	5 127
3 - 1/2"	4.00 101,6	9 228,6	1 - 3/16 30,2	5 - 1/2 139,7
4"	4.50 114,3	10 254	1 - 1/4 31,7	6 - 3/16 157,2
5"	5.563 141,3	11 279,4	1 - 3/8 34,9	7 - 5/16 185,7
6"	6.625 168,3	12 - 1/2 317,5	1 - 7/16 36,5	8 - 1/2 215,9
8"	8.625 219,1	15 381	1 - 5/8 41,3	10 - 5/8 269,9
10"	10.75 273	17 - 1/2 444,5	1 - 7/8 37,6	12 - 3/4 323,8
12"	12.75 323,8	20 - 1/2 520,7	2 50,8	15 381
14"	14.0 355,6	23 584,2	2 - 1/8 54,0	16 - 1/4 412,7
16"	16.0 406,4	25 - 1/2 647,7	2 - 1/4 57,2	18 - 1/2 469,9
18"	18.0 457,2	28 711,2	2 - 3/8 60,3	21 533,4
20"	20.0 508	30 - 1/2 774,7	2 - 1/2 63,5	23 584,2
24"	24.0 609,6	36 914,4	2 - 3/4 69,8	27 - 1/4 692,1

# Standard Pipe Flanges



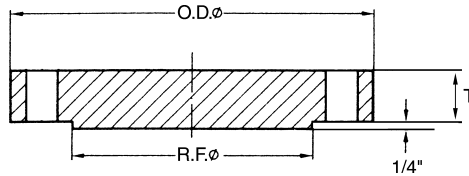
*Blind Flange*

600 lb/sq. in.		ANSI (ASA) b 16.5		
Pipe		Flange		Raised Face
Nominal Size NW	O.D. in. mm	O.D. in. mm	T in. mm	R.F. in. mm
1/2"	0.84 21,3	3 - 3/4 95,2	9/16 14,3	1 - 3/8 34,9
3/4"	1.05 26,7	4 - 5/8 117,5	5/8 15,9	1 - 11/16 42,9
1"	1.315 33,4	4 - 7/8 123,8	11/16 17,5	2 50,8
1 - 1/4"	1.66 42,2	5 - 1/4 133,3	3/4 19,0	2 - 1/2 63,5
1 - 1/2"	1.90 48,3	6 - 1/8 155,6	13/16 20,6	2 - 7/8 73,0
2"	2.375 60,3	6 - 1/2 165,1	7/8 22,2	3 - 5/8 92,1
2 - 1/2"	2.875 73,0	7 - 1/2 190,5	1 25,4	4 - 1/8 104,8
3"	3.50 88,9	8 - 1/4 209,5	1 - 1/8 28,6	5 127
3 - 1/2"	4.00 101,6	9 228,6	1 - 3/16 30,2	5 - 1/2 139,7
4"	4.50 114,3	10 - 3/4 273	1 - 1/2 38,1	6 - 3/16 157,2
5"	5.563 141,3	13 330,2	1 - 3/4 44,4	7 - 5/16 185,7
6"	6.625 168,3	14 355,6	1 - 7/16 36,5	8 - 1/2 215,9
8"	8.625 219,1	16 - 1/2 419,1	2 - 3/16 55,6	10 - 5/8 269,9
10"	10.75 273	20 508	2 - 1/2 63,5	12 - 3/4 323,8
12"	12.75 323,8	22 558,8	2 - 5/8 66,7	15 381
14"	14.0 355,6	23 - 3/4 603,2	2 - 3/4 69,8	16 - 1/4 412,7
16"	16.0 406,4	27 685,8	3 76,2	18 - 1/2 469,9
18"	18.0 457,2	29 - 1/4 742,9	3 - 1/4 82,5	21 533,4
20"	20.0 508	32 812,8	3 - 1/2 88,9	23 584,2
24"	24.0 609,6	37 939,8	4 101,6	27 - 1/4 692,1

900 lb/sq. in.		ANSI (ASA) b 16.5		
Pipe		Flange		Raised Face
Nominal Size NW	O.D. in. mm	O.D. in. mm	T in. mm	R.F. in. mm
1/2"	0.84 21,3	4 - 3/4 120,6	7/8 22,2	1 - 3/8 34,9
3/4"	1.05 26,7	5 - 1/8 130,2	1 25,4	1 - 11/16 42,9
1"	1.315 33,4	5 - 7/8 149,2	1 - 1/8 28,6	2 50,8
1 - 1/4"	1.66 42,2	6 - 1/4 158,7	1 - 1/8 28,6	2 - 1/2 63,5
1 - 1/2"	1.90 48,3	7 177,8	1 - 1/4 31,7	2 - 7/8 73,0
2"	2.375 60,3	8 - 1/2 215,9	1 - 1/2 38,1	3 - 5/8 92,1
2 - 1/2"	2.875 73,0	9 - 5/8 244,5	1 - 5/8 41,3	4 - 1/8 104,8
3"	3.50 88,9	9 - 1/2 241,3	1 - 1/2 38,1	5 127
4"	4.50 114,3	11 - 1/2 292,1	1 - 3/4 44,4	6 - 3/16 157,2
5"	5.563 141,3	13 - 3/4 349,2	2 50,8	7 - 5/16 185,7
6"	6.625 168,3	15 381	2 - 3/16 55,6	8 - 1/2 215,9
8"	8.625 219,1	18 - 1/2 469,9	2 - 1/2 63,5	10 - 5/8 269,9
10"	10.75 273	21 - 1/2 546,1	2 - 3/4 69,8	12 - 3/4 323,8
12"	12.75 323,8	24 609,6	2 - 5/8 79,4	15 381
14"	14.0 355,6	25 - 1/4 641,3	3 - 3/8 85,7	16 - 1/4 412,7
16"	16.0 406,4	27 - 3/4 704,8	3 - 1/2 88,9	18 - 1/2 469,9
18"	18.0 457,2	31 787,4	4 101,6	21 533,4
20"	20.0 508	33 - 3/4 857,2	4 - 1/4 107,9	23 584,2
24"	24.0 609,6	41 1041,4	5 - 1/2 139,7	27 - 1/2 692,1



# Standard Pipe Flanges



*Blind Flange*

1500 lb/sq. in.		ANSI (ASA) b 16.5		
Pipe		Flange		Raised Face R.F.
Nominal Size NW	O.D. in. mm	O.D. in. mm	T in. mm	in. mm
1/2"	0.84 21,3	4 - 3/4 120,6	7/8 22,2	1 - 3/8 34,9
3/4"	1.05 26,7	5 - 1/8 130,2	1 25,4	1 - 11/16 42,9
1"	1.315 33,4	5 - 7/8 149,2	1 - 1/8 28,6	2 50,8
1 - 1/4"	1.66 42,2	6 - 1/4 158,7	1 - 1/8 28,6	2 - 1/2 63,5
1 - 1/2"	1.90 48,3	7 177,8	1 - 1/4 31,7	2 - 7/8 73,0
2"	2.375 60,3	8 - 1/2 215,9	1 - 1/2 38,1	3 - 5/8 92,1
2 - 1/2"	2.875 73,0	9 - 5/8 244,5	1 - 5/8 41,3	4 - 1/8 104,8
3"	3.50 88,9	10 - 1/2 266,7	1 - 1/8 47,6	5 127
4"	4.50 114,3	12 - 1/4 311,1	2 - 1/8 54,0	6 - 3/16 157,2
5"	5.563 141,3	14 - 3/4 374,6	2 - 7/8 73,0	7 - 5/16 185,7
6"	6.625 168,3	15 - 1/2 393,7	3 - 1/4 82,5	8 - 1/2 215,9
8"	8.625 219,1	19 482,6	3 - 5/8 92,1	10 - 5/8 269,9
10"	10.75 273	23 584,2	4 - 1/4 107,9	12 - 3/4 323,8
12"	12.75 323,8	26 - 1/2 673,1	4 - 7/8 123,8	15 381
14"	14.0 355,6	29 - 1/2 749,3	5 - 1/4 133,3	16 - 1/4 412,7
16"	16.0 406,4	32 - 1/2 825,5	5 - 3/4 146	18 - 1/2 469,9
18"	18.0 457,2	36 914,4	6 - 3/8 161,9	21 533,4
20"	20.0 508	38 - 3/4 984,2	7 177,8	23 584,2
24"	24.0 609,6	46 1168,4	4 203,6	27 - 1/4 692,1

2500 lb/sq. in.		ANSI (ASA) b 16.5		
Pipe		Flange		Raised Face R.F.
Nominal Size NW	O.D. in. mm	O.D. in. mm	T in. mm	in. mm
1/2"	0.84 21,3	5 - 1/4 133,3	1 - 3/16 30,2	1 - 3/8 34,9
3/4"	1.05 26,7	5 - 1/2 139,7	1 - 1/4 31,7	1 - 11/16 42,9
1"	1.315 33,4	6 - 1/4 158,7	1 - 1/8 34,9	2 50,8
1 - 1/4"	1.66 42,2	7 - 1/4 184,1	1 - 1/2 38,8	2 - 1/2 63,5
1 - 1/2"	1.90 48,3	8 203,2	1 - 3/4 44,4	2 - 7/8 73,0
2"	2.375 60,3	9 - 1/4 234,9	2 50,8	3 - 5/8 92,1
2 - 1/2"	2.875 73,0	10 - 1/2 266,7	2 - 1/4 57,1	4 - 1/8 104,8
3"	3.50 88,9	12 304,8	2 - 5/8 66,7	5 127
4"	4.50 114,3	14 355,6	3 76,2	6 - 3/16 157,2
5"	5.563 141,3	16 - 1/2 419,1	3 - 5/8 92,1	7 - 5/16 185,7
6"	6.625 168,3	19 482,6	4 - 1/4 107,9	8 - 1/2 215,9
8"	8.625 219,1	21 - 3/4 552,4	5 127	10 - 5/8 269,9
10"	10.75 273	26 - 1/2 673,1	6 - 1/2 165,1	12 - 3/4 323,8
12"	12.75 323,8	30 762	7 - 1/4 184,1	15 381

# Decimal Equivalents of Pipe Sizes

## Dimensions in Inches – Wall Thickness of

Pipe Size	O.D.	Sch 40	Sch 80	Sch 120	Sch 160	Double Extra Heavy
1/8	.405	.068	.095			
1/4	.540	.088	.119			
3/8	.675	.091	.126			
1/2	.840	.109	.147		1.88	.294
3/4	1.050	.113	.154		.218	.308
1	1.315	.133	.179		.250	.358
1-1/4	1.660	.140	.191		.250	.382
1-1/2	1.900	.145	.200		.281	.400
2	2.375	.154	.218		.343	.436
2-1/2	2.875	.203	.276		.375	.552
3	3.500	.216	.300		.437	.600
3-1/2	4.000	.226	.318			.636
4	4.500	.237	.337	.437	.531	.674
4-1/2	5.000	.247	.355			.710
5	5.563	.258	.375	.500	.625	.750
6	6.625	.280	.432	.562	.718	.864
7	7.625	.301	.500			.875
8	8.625	.322	.500	.718	.906	.875
9	9.625	.342	.500			
10	10.750	.365	.500	.843	1.125	
11	11.750	.375	.500			
12	12.750	.375	.500	1.000	1.312	
14	14.000	.375	.500	1.093	1.406	
16	16.000	.375	.500	1.218	1.593	
18	18.000	.375	.500	1.375	1.781	
20	20.000	.375	.500	1.500	1.968	
24	24.000	.375	.500	1.812	2.343	

Pipe Size	Pipe O.D.	Nominal Wall Thickness		Actual Inside Diameter	
		Std Sch 40	Ex Hvy Sch 80	Std Sch 40	Ex Hvy Sch 80
1/8"	.405	.068	.095	.267	.215
1/4"	.540	.088	.119	.364	.302
3/8"	.675	.091	.126	.493	.423
1/2"	.840	.109	.147	.622	.546
3/4"	1.050	.113	.154	.824	.742
1"	1.315	.133	.179	1.049	.957
1-1/4"	1.660	.140	.191	1.380	1.278
1-1/2"	1.900	.145	.200	1.610	1.500
2"	2.375	.154	.218	2.067	1.939
2-1/2"	2.875	.203	.276	2.469	2.323
3"	3.500	.216	.300	3.068	2.900

# Safe and Accurate Solutions for Difficult Process Applications



## ◀ Industrial Thermocouples & RTDs

In most process applications the temperature sensor is inserted into a thermowell or protection tube. This protects the sensor from its environment and facilitates easy removal and replacement. These assemblies generally consist of a head, nipple-union-nipple and thermowell. Smart industrial thermocouples and RTDs are available in virtually any calibration and resistance temperature coefficient.



## ◀ Thermowells

Proper temperature element protection starts with the selection of the thermowell or protection tube. Conditions that influence the selection, include the temperature, pressure, flow velocity, pipe size, insertion length and the process environment and medium. A variety of materials and process connections are available for both thermowells and protection tubes. All metallic wells are constructed in strict compliance with ASTM and ANSI specifications. For higher temperatures ceramic protection tubes are available. Fluid flowing by a thermowell forms a turbulent wake that has a defined frequency. The thermowell must have adequate stiffness so its natural frequency is greater than the wake frequency. Let Smart Sensors help you design your well around your process conditions. Free velocity calculations are a phone call away. Smart Sensors complete family of bar stock wells and protection tubes can provide safe and reliable protection for any process environment.



## ◀ Heads

Smart Sensors can provide a head for virtually any process application. From our rugged explosion proof head used in hazardous locations to our water resistant head that provides a weather tight seal or our plastic design that can withstand caustic wash downs for CIP and sanitary applications. These heads are available in Cast Aluminum, Stainless Steel, Cast Iron and plastic. The conventional threaded type and the new flip-top threadless design are available for your convenience. All metal heads can accept either a sensor terminal block or a DIN size temperature transmitter.



## ◀ Miniature Thermocouples & RTDs

Miniature thermocouples and RTDs are generally used where thermowells are not necessary and are commonly found in pilot plants, research and development, furnace, and OEM applications. Thermocouple constructions with diameters as small as .010 inches are available with grounded and ungrounded measuring junctions. All miniature calibrations can be provided with flexible leads and a variety of connector terminations.



## ◀ Temperature Transmitters and Indicators

Transmitter can accept an input from thermocouples or RTDs and produce an analog or digital output. All outputs are linear with temperature. The instrument can be programmed using software (easily downloaded to your personal computer) or a common hand held programming device. A five year warranty is standard on all transmitters. Hand held and panel mountable digital thermocouple indicators have large displays and accuracies normally found in instruments three times more expensive.

Temperature Measurement...the Right Way!



