

Temperature Sensors: High Temperature Thermocouple Probes

CONVECTRONICS offers thermocouples utilizing noble metals, refractory metals, refractory ceramics and other exotic materials for the sheath, thermocouple wires and insulation. Our thermocouples are fabricated using the highest manufacturing standards available, which ensures maximum performance and life for these sensors.

Thermocouple Elements

| Calibration | Max. Oper. Temp. | Max. Ex-pos. Temp. | Recommended Environment |
|--|------------------|--------------------|---|
| Pt-10% Rh/Pt ANSI Type S | 2700°F 1482°C | 3100°F 1704°C | Oxidizing, Inert |
| Pt-13% Rh/Pt ANSI Type R | 2700°F 1482°C | 1300°F 1704°C | Oxidizing, Inert |
| Pt-30% Rh/Pt-6%Rh ANSI Type B | 3100°F 1704°C | 3220°F 1770°C | Oxidizing, Inert |
| W/W-26% Re W-5% Re/W-26%Re W-3% Re/W-25%Re | 5000°F 2760°C | 5430°F 3000°C | Vacuum, High Purity, Hydrogen & Inert. |

Pt-Platinum, Rh-Rhodium, W-Tungsten, Re-Rhenium

Refractory Oxide Insulators

The resistivity of metal oxides decreases with increasing temperature. Above 3600°F only beryllia retains sufficient resistivity for most applications.

| Material | Approx. Melt. Temp. | Max. Rec. Temp. | |
|---|---------------------|------------------|------------------|
| | | Hard-Fired | Swaged |
| Magnesia MgO | 5070°F 2800°C | N/A | 3400°F 1870°C |
| Alumina AL ₂ O ₃ | 3650°F 2010°C | 3200°F 1760°C | 3000°F 1650°C |
| Beryllia* BeO | 4620°F 2550°C | 4200°F 2315°C | N/A |
| Hafnia HfO ₂ | 5252°F 2900°C | 4352°F 2400°C | N/A |

* Caution: Beryllia Dusts are toxic

Application

Oxidizing, reducing and inert gas furnaces, gas burners, ovens, nuclear power generating plants, exhaust gases, wind tunnels, pollution control and high temperature process control applications.

Specifications of Sheath Materials

TANTALUM (Ta):

Melting point of 5430°F. The most corrosive resistant of the refractory metals. Corrosion resistant to most chemicals up to 3000°F. Good in reducing or neutral atmospheres at elevated temperatures. Poor in oxidizing atmospheres. Excellent for thermal cycling applications.

MOLYBDENUM (Mo):

Excellent mechanical properties at elevated temperatures. Melting point at 4750°F. Excellent in reducing or neutral atmospheres. It has low thermal-neutron capture cross-section and excellent thermal shock resistance. Poor in oxidizing atmospheres. Excellent for thermal cycling applications.

ALUMINA (AL₂O₃):

This high purity sintered aluminum oxide (99.5% AL₂O₃, dense) has a melting point of 3686°F (2030°C) and an upper working service temperature of 3452°F (1900°C). It can be used in oxidizing, reducing or high vacuum applications. (Not recommended for use in high vacuum environments in the presence of graphite at temperatures exceeding 2372°F (1300°C)). AL₂O₃ has high thermal conductivity and therefore good resistance to thermal shock. It has excellent resistance to chemical attack. Poor for thermal cycling applications.

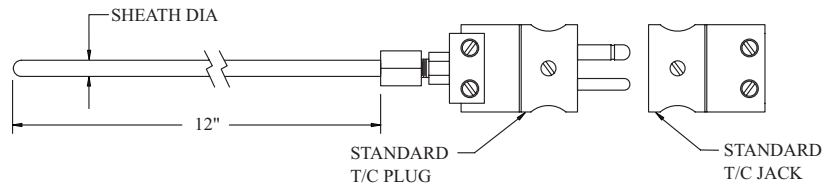
ZIRCONIA (ZRO₂):

Zirconium oxide is fully stabilized with exceptional refractory properties, which include the highest melting point and lowest thermal conductivity of any refractory. It is not wet by most molten metals, is generally inert to oxidizing and reducing atmospheres, and resists most chemical reactions. Usable to 4400°F, it is impervious (0% water absorption). Poor for thermal cycling applications.

FUSED QUARTZ:

(Fused silica) consists of 99.9% SiO₂. Most acids, metals, chlorine and bromine are unreactive with fused silica at ordinary temperatures. It is slightly attacked by alkaline solutions, the reaction rate increasing with temperature and concentration of thermal expansion, 0.55 x 10⁻⁶ cm/cm/°F (0-572°F). This is 1/34th that of copper, 1/17th of platinum and 1/9th of tungsten. This low expansion produces a high thermal shock resistance, it can be heated to 2700°F, and immersed into ice water without cracking. Good for oxidizing, inert or neutral atmospheres to 3050°F. Excellent for thermal shock applications. Divitrifies rapidly at temperatures above 1800°F causing microscopic surface cracking (hazy film) upon cooling.

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| Sheath Size DIA | Sheath Material | ANSI Type | Junction Type | Part Number | STD Length (in.) Sheath |
|-----------------|-----------------|--------------|---------------|-------------|-------------------------|
| 1/8 | MOLYBDENUM (MO) | B,C,R, S,F,G | Ungrounded | T□AK2-12.05 | 12 |
| 3/16 | | | | T□AK3-12.05 | 12 |
| 1/4 | | | | T□AK4-12.05 | 12 |
| 3/8 | | | | T□AK5-12.05 | 12 |

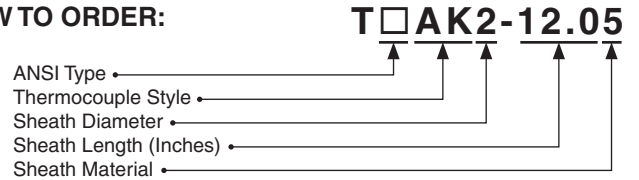
| Sheath Size DIA | Sheath Material | ANSI Type | Junction Type | Part Number | STD Length (in.) Sheath |
|-----------------|-----------------|--------------|---------------|-------------|-------------------------|
| 1/8 | TANTALUM (TA) | B,C,R, S,F,G | Ungrounded | T□AK2-12.06 | 12 |
| 3/16 | | | | T□AK3-12.06 | 12 |
| 1/4 | | | | T□AK4-12.06 | 12 |
| 3/8 | | | | T□AK5-12.06 | 12 |

| Sheath Size DIA | Sheath Material | ANSI Type | Junction Type | Part Number | STD Length (in.) Sheath |
|-----------------|--|--------------|---------------|-------------|-------------------------|
| 1/8 | ALUMINIA (AL ₂ O ₃) | B,C,R, S,F,G | Ungrounded | T□AK2-12.08 | 12 |
| 3/16 | | | | T□AK3-12.08 | 12 |
| 1/4 | | | | T□AK4-12.08 | 12 |
| 3/8 | | | | T□AK5-12.08 | 12 |

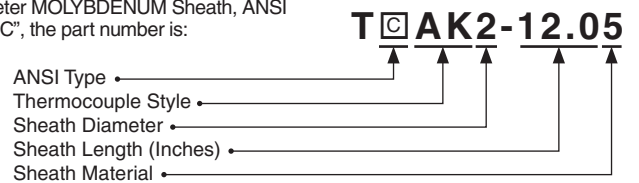
| | | | | | |
|-----|------------------------------|--------------|------------|-------------|----|
| 1/4 | ZIRCONIA (ZRO ₂) | B,C,R, S,F,G | Ungrounded | T□AK4-12.07 | 12 |
| 3/8 | | | | T□AK5-12.07 | 12 |

| | | | | | |
|-----|-------------|--------------|------------|-------------|----|
| 1/4 | QUARTZ (QR) | B,C,R, S,F,G | Ungrounded | T□AK4-12.09 | 12 |
| 3/8 | | | | T□AK5-12.09 | 12 |

HOW TO ORDER:



EXAMPLE: To order a 12" long 1/8" Diameter MOLYBDENUM Sheath, ANSI Type "C", the part number is:



- * Maximum service temperatures not to exceed 1500°C.
- * For higher service temperatures consult factory.
- * The standard thermocouple is available with a thick wall metal support tube (4" long standard) attached to the connector end. The support tube is 1/8 larger in diameter than the sheath diameter. The support tube is used to eliminate any damage to the refractory sheath that may be caused by a mounting bushing.

- * If a support tube is desired, insert suffix (ST) to the part number
- * When ordering, specify part number and quantity. If sheath length is other than 12", specify accordingly and adjust base price.
- * Other style termination available.
- * Multiple junction units are available - consult factory.